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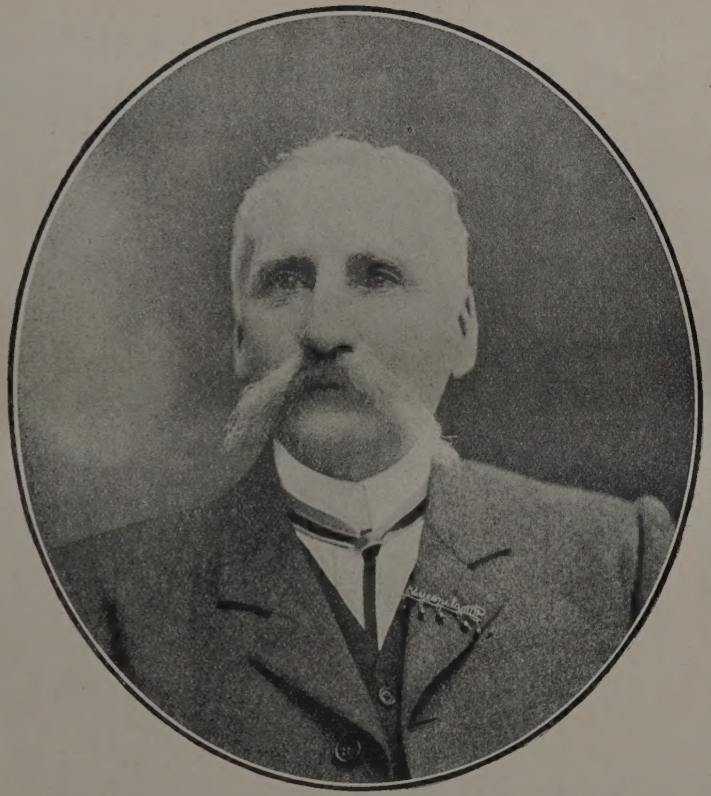
EDITORIAL CHANGE.

In this issue we take official farewell of Major A. J. Boyd, F.R.G.S.Q., who has retired from the control of this Journal, under the provisions of the Public Service Act. Major Boyd has been associated with "The Queensland Agricultural Journal" as editor since its first issue in July, 1897, and in the course of the time that has since elapsed he became the friend of practically every farmer in the State. The Journal is his monument. By general consensus of opinion in literary and agricultural circles the publication, under his direction, attained a high standard, and became a credit to the Department and the State. Since his retirement Major Boyd has been the recipient of appreciative notices of his great work in the cause of agricultural education from all parts of the Commonwealth. He carries with him into unofficial life the good wishes of all his old departmental colleagues and of all connected with Queensland rural interests which, for a quarter of a century, he served so ably. Mr. J. F. F. Reid, who succeeds Major Boyd, has had many years' practical agricultural, pastoral, and journalistic experience in Queensland. He served in the ranks and as an officer of the A.I.F., and, after the armistice, spent over twelve months in the study of various phases of rural industry on the Continent of Europe and in the United Kingdom.



MAJOR A. J. BOYD, F.R.G.S.Q., LATE EDITOR.

HIS SUCCESSOR, MR. J. F. F. REID.

PLATE 26.

Agriculture.

DIGESTIBILITY OF FODDER.

By J. C. BRUNNICH and V. S. RAWSON.

[Read before the Hobart-Melbourne meeting of the Australasian Association for the Advancement of Science.]

(Continued from May Journal.)

BRAN.

	Organic Matter.	Crude Protein.	Fat.	N.F.E.	Fibre.	True Protein.	Starch Equivalent.
Analysis	84·29	14·26	4·48	55·71	9·84	12·85	..
Digestible	62·04	11·42	2·67	44·34	3·61	10·01	48·86
Digestible Co-efficient	73·6	80·1	59·7	79·6	37·0	77·8	..
HENRY—WINTER BRAN.							
Analysis	83·1	15·7	4·4	54·2	8·8	..	..
Co-efficient	67·0	78·0	65·0	71·0	28·0	..	..
HENRY—SPRING BRAN.							
Analysis	84·3	15·7	4·8	52·6	10·2	..	..
Co-efficient	69·0	76·0	62·0	74·0	43·0	..	..
KELLNER.							
Co-efficient	69·0	79·0	71·0	71	26·0	..	..

The digestibility of the bran does not show any great difference from the American or German figures for the digestibility co-efficients, but there is one point which is worthy of some consideration for further investigation. It will be noticed that the digestibility of fat in both pollard and bran is low compared with other standards, whilst that of fibre is higher; also in other products this constituent is more digestible. On comparing the figures of Henry for the digestibility of these two factors in winter bran and spring bran the digestibility of fat in the latter is lower, whilst of the fibre it is considerably higher. Owing to its period of growth the bran produced from the Australian wheat would be expected to resemble more closely the bran produced from spring wheat than from winter wheat, and this appears to be the case from our results of digestibility. Though the digestibility of the protein is fairly high in the sample analysed, it is worthy of note that that of the spring wheat is lower than that of the winter, and, as will be noticed, there are several cases of low digestibility in the samples here analysed. Likewise with the hay the growth is more rapid and hence probably the fibre is more digestible; this might also account for the low digestibility of the protein.

Before leaving the question of bran and pollard, it must be remembered there are a very large number of varieties of wheats in Australia, and it does not necessarily follow that the by-products from a strong and weak wheat would have the same co-efficient of digestibility. A further point worthy of note in comparing these two products is that both give approximately the same amount of digestible constituents, but the work exerted in mastication and digestion of the pollard is practically negligible, whilst in the case of bran, according to Kellner, 33 per cent. of the total starch value is employed therein, and thus we obtain a net starch value for bran considerably below that of pollard.

MAIZE MEAL.

——	Organic Matter.	Crude Protein.	Fat.	N.F.E.	Fibre.	True Protein.	Starch Equivalent.
Analysis	85·28	8·57	3·65	71·03	2·03	8·05	..
Digestible	69·20	5·13	3·07	59·88	1·12	4·61	..
Digestible co-efficient	81·10	59·9	84·1	84·3	55·1	57·4	71 84
(I) AFTER HENRY (12 SAMPLES).							
Digestible co-efficient	..	74·0	93·0	94·0	57·0	..	..
(II) AFTER JORDAN (5 SAMPLES).							
Digestible co-efficient	89·6	67·9	92·1	94·6	..	..	..
(III) AFTER KELLNER (AVERAGE).							
Digestible co-efficient	90·0	72·0	89·0	95·0	58·0	..	..
(IV) AFTER KELLNER (MINIMUM).							
Digestible co-efficient	83·0	58·0	81·0	87·0	46·0	..	..

Except in the digestibility of the fibre, the digestibility of our maize is much poorer than that of the averages of maizes from Germany and America. It is of interest to note, however, that there is considerable difference in the two averages mentioned from America; further, it should be mentioned that in twenty-three investigations by Kellner, the digestibility of the protein varied from 58 to 84 per cent. The lowest figures given by Kellner are very similar to those obtained by us, and it would be unfair to assume that all maizes grown in Australia show such a low percentage of digestibility as compared with those from other countries.

ENSILAGE.

The sample of ensilage which was obtained for this experiment was made at the Yeerongpilly Experimental Station, and consisted of a mixture of maize and millet. To obtain accurate results, samples were taken each day, from the quantity fed, for analysis, and the experiment was successfully carried out in triplicate, in two cases with bran and hay and in the third lucerne and hay. The results agreed very closely in the two mixtures.

——	Organic Matter.	Crude Protein.	Crude Fat.	N.F.E.	Fibre.	True Protein.	Starch Equivalent.
Analysis	27·90	1·44	·59	16·10	9·77	1·20	..
Digestible	16·83	·33	·36	10·18	5·96	·09	..
Digestible co-efficient	60·1	22·9	60·9	63·2	61·00	7·5	12·53
KELLNER—MAIZE ENSILAGE.							
Digestible co-efficient (average)	67	51	80	67	71	..	..
Digestible co-efficient (minimum)	57	22	65	55	56	..	..

Comparing this silage with those from American averages, the results seem to show that the protein digestibility is very inferior. It is also much lower than those given for maize ensilage by Kellner, though the lowest of thirteen different sorts of this silage gave results very similar to the one analysed in Queensland. The same remarks apply here as in the case of maize meal. It is generally known that in the making of ensilage much of the protein is converted into the less complex nitrogenous bodies as amides and amines, which have not the same value as foodstuffs. There is no doubt that the system of ensilaging is a good manner of conserving fodder, though at the same time there is considerable loss. Dr. E. J. Russell, F.R.S., now Director of Rothamsted, about twelve years ago showed by experiment at the South-Eastern Agricultural College that there was a loss, chiefly of protein and nitrogen free extract, of from 30 to 40 per cent. of the dry matter in ensilage, though in America this has been brought down to about 20 per cent. In a country such as Australia, if properly carried, the making of ensilage should be of great value, but much investigation is needed as to the best manner in so doing, and it is of importance to make systematic analyses of both total and digestible nutrients of such fodder. It would be of value even to carry out an investigation as to its digestibility on those State Farms throughout Australia where ensilage is made, and to compare results.

COARSE DRIED BLOOD.

——	Organic Matter.	Crude Protein.	Crude Fat.	N.F.E.	Fibre.	True Protein.	Starch Equivalent.
Analysis	82·98	78·75	1·88	2·35	..	77·96	..
Digestible	52·11	47·88	1·88	2·35	..	47·09	..
Co-efficient	62·80	60·8	100	100	..	60·4	50·6
		AFTER KELLNER.					
Digestible co-efficient	63·0	62·0	100	100	..	..	..

This sample of blood meal was hard and coarsely ground. During the time of the experiment it was suggested that a specially prepared finely ground blood meal now on the market should be much more digestible, and a further experiment was carried out with this blood, at the same time feeding the same basal ration of pollard, lucerne, and hay with the coarsely ground blood to two other sheep as control. Although the figures for nitrogen free extract and fat cannot be relied upon, the duplicate analyses compared fairly well, and the fact was brought out that though the fine sample was distinctly lower in protein matter, more especially true protein, the amount of digestible true protein and organic matter was very much greater.

FINE BLOOD MEAL.

——	Organic Matter.	Crude Protein.	Fat.	N.F.E.	Fibre.	True Protein.	Starch Equivalent.
Analysis	80·77	71·40	3·39	5·98	..	68·69	..
Digestible	71·33	63·55	3·05	4·54	..	60·84	68·19
Digestible co-efficient	88	89·0	89·9	75·9	..	88·6	..

It will be seen from these figures that both crude and true protein are nearly 50 per cent. more digestible in the case of the fine blood meal than in coarse blood, and whereas the total true protein is 9 per cent. lower in the fine sample, the digestible co-efficient of the true protein is 29 per cent. higher, thus showing the importance of testing the digestibility of foodstuffs to supplement the ordinary analysis.

MITCHELL GRASS HAY.

This sample of hay, which was secured from the north-west of Queensland, gave very unsatisfactory results both as to analysis and digestibility.

——	Organic Matter.	Crude Protein.	Fat.	N.F.E.	Fibre.	True Protein.	Starch Equivalent.
Analysis	76·86	3·63	1·04	29·74	42·45	3·50	..
Digestible	36·47	·63	·41	9·75	25·68	·50	..
Digestible co-efficient	47·5	17·5	39·60	32·80	60·5	14·4	13·75
Digestible co-efficient of hay in hay and 20 per cent. lucerne	42·2	14·8	41·4	32·6	51·4	..	..

On comparing this sample of Mitchell hay with that of the poor bush hay, it will be seen that the analysis is of a very similar nature, except that the protein and fibre are higher and the carbohydrates less. The digestible co-efficients are also very similar, though the carbohydrates here are considerably less. This may be accounted for in that the sample of hay was three years old. The hay was fed alone and also with lucerne hay. In the latter case the digestible co-efficients were considerably less, and the figures given are those of the hay fed alone. Whether the lower figures in the case of the hay fed with lucerne were due to the influence of the lucerne, or owing to using a new bag*, though from the same lot of hay previously used, it is

* This does not appear probable as ensilage, which was fed with bran in the one case and with lucerne in the other, gave approximately identical co-efficients of digestibility.

too difficult to say, but the interesting point is that in experiments carried out in North Carolina some years ago the same diminution was found in the digestibility of old Timothy hay in feeding with a more concentrated food. In the three cases of the two hays and the ensilage, it must be borne in mind that the digestibility as before stated is the apparent digestibility only, and the lower the protein percentage in the fodder the greater is the error brought about by extra nitrogenous compounds in the excreta. The low starch value of this sample is partly brought about by the reduction necessary on account of the high amount of fibre.

In conclusion, two things are brought out by these experiments which are of considerable value, and these are that, whilst the digestibility of the protein and fat is somewhat lower in Australian fodders than those from America and Germany, that of the fibre is distinctly higher, and, as indicated in the discussion of the bran, this is probably due to the more quickly growing nature of the plants in this country. In connection with the lower digestibility of the proteins, especially in the roughages, it is of interest that, according to figures taken from "Sheep and Wool," by A. Hawkesworth, the nitrogen contents of wool is about 2 per cent. lower in Australian than in English wool. In the feeding of animals there are many points to elucidate before we arrive at any definite conclusions. In Europe and America special institutes for research work on animal nutrition are to be found, and as yet there is not a single institute devoted to this work in Australia. There can be no doubt that such work is of prime importance to a country with such different conditions of climate and soil, and where agriculture is one, if not the greatest, mainstay of the people, and it is to be hoped that under the new Institute of Science and Industry these questions will hold a prominent position for the sake of the agriculturists in Australia.

APPENDIX.

Data from Experiment with Hay and Lucerne.

Amount of food eaten by sheep—Lucerne, 3,336 grams; hay, 5,368 grams.

ANALYSIS OF LUCERNE.		ANALYSIS OF HAY.
Moisture	10·06	16·31
Crude protein	15·95	2·95
Crude fat	1·40	·77
N.F.E.	38·21	39·94
Fibre	25·40	34·55
Ash	8·98	5·48
Insol. ash	·76	3·64
True protein	12·36	2·63

AMOUNT OF FÆCES OBTAINED FROM SHEEP.

Wet fæces	6,250 grams.
Dry fæces	3,270 grams.
Percentage of moisture	47·7

ANALYSES OF FÆCES.

	Dry. Per cent.	Wet. Per cent.
Moisture	8·18	51·98
Crude protein	7·53	3·94
Crude fat	1·61	·84
Nitrogen extract	41·12	21·51
Crude fibre	30·44	15·92
Ash	11·12	5·81
Insoluble ash	6·30	

AMOUNT OF MATERIAL IN FODDER.

——	Organic Matter.	Crude Protein.	Crude Fat.	N.F.E.	Fibre.	True Protein.
3,336 grams lucerne	2,700·5	532·1	46·7	1,274·4	847·3	412·3
5,368 grams hay	4,198·3	158·3	41·3	2,144·0	1,854·6	141·2
Total	6,898·8	690·4	88·0	3,418·4	2,701·9	583·5

AMOUNT OF MATERIAL IN FÆCES.

Total	2,639·0	246·0	52·6	1,334·0	995	..
Calculated from lucerne	770·0	114·0	24·9	340·0	296	..
Calculated from hay	1,869·0	132·0	27·7	994·0	699	..
Amount of hay digested	2,329·3	26·3	13·6	1,150·0	1,155·6	9·2
Percentage digested	55·5	16·6	33·0	53·7	62·6	6·5

Duplicate Testing of Digestibility of Hay.

Amount of food eaten—Lucerne, 2,290 grams; hay, 4,486 grams.

AMOUNT OF FÆCES OBTAINED FROM SHEEP.

Wet fæces	6,150 grams
Dry fæces	2,590 grams.
Percentage of moisture ..	57·9

ANALYSES OF FÆCES.

	Dry.	Wet.
Moisture	7·74 ..	61·16
Crude protein	7·08 ..	2·98
Crude fat	1·57 ..	·66
Nitrogen free extract	42·14 ..	17·74
Crude fibre	30·40 ..	12·80
Ash	11·07 ..	4·66

AMOUNT OF MATERIAL IN FODDER.

——	Organic Matter.	Crude Protein.	Crude Fat.	N.F.E.	Fibre.	True Protein.
2,290 grams lucerne	1,854·0	365·3	32·4	875·0	581·7	283·0
4,486 grams hay	3,508·4	132·3	35·5	1,792·5	1,550·0	118·1
Total	5,362·4	497·6	67·9	2,667·5	2,131·7	401·1

AMOUNT OF MATERIAL IN FÆCES.

Total	2,103·0	183·0	40·6	1,092·0	787·5	..
Calculated from lucerne	529·0	71·0	17·2	235·0	203·5	..
From hay	1,574·0	112·0	23·4	857·0	584·0	..
Amount of hay digested	1,934·4	20·3	12·1	935·5	966·0	6·1
Percentage hay digested	55·2	15·3	34·1	52·2	62·3	5·2

The Chemical Laboratory,
Department of Agriculture and Stock,
Brisbane.

WINTER SCHOOL FOR FARMERS, 1921.

The Winter School Course embraces a variety of subjects, the whole of which it is impossible for one student to take up; but students are expected to select such branches of training as may be best suited to the conditions of their own districts and farms. The Course of Instruction will be continued for three weeks from 13th June to 2nd July, 1921. Farmers and graziers, or their sons over 18 years of age, who have worked at least one year on the land, are eligible for admission. Application for entrance must be forwarded to the Principal of the College not later than the 1st June.

A fee of £3 3s. is charged for the course. This covers board, lodging, and tuition at the College. The fee is payable in advance. All students are to be subject to the regulations in force at the College. Each student must provide himself with towels, blankets, sheets, pillow-cases, soap, and other personal requisites, and students are advised to bring suitable warm clothing. The College Reference and Circulating Library and the Reading-rooms are made available for students. The Gymnasium and Recreation Grounds are well equipped and can be used by students. Laundry work can be arranged for, but must be paid for in cash.

The course will include lectures and demonstrations on the following subjects:—Principles of Stock Breeding; Feeds and Feeding; Farm Economics; Elementary Veterinary Work; Forage Crops and Conservation of Fodder—Silage and Silage Making; Pastures and Pasturage; Soils and Soil Fertility; Seed Selection and Seed Testing; Milk and Cream Testing—Herd Testing; Butter and Cheese—Cream Grading; Bacteriology in Relation to the Farm; Wool Classing—Sheep; Poultry Farming; Pig Farming—Bacon Curing; Elementary Bookkeeping; Orcharding.

All students will be expected to attend lectures in the first five subjects, and each intending student should indicate in his application which of the remainder he desires to take up.

In addition to the above, practical tuition will be provided in Carpentry, Blacksmithing, Saddlery, and Engine-driving. Further, each section of the farm will be open daily for inspection and observation of the general routine practised.

CONFERENCE OF MINISTERS OF AGRICULTURE.

An Interstate Conference of Ministers of Agriculture was held at Adelaide in the course of the month. The Hon. W. N. Gillies, accompanied by Messrs. E. G. Scriven (Under Secretary, Department of Agriculture and Stock) and E. Graham (State Dairy Expert) represented Queensland.

The conference affirmed its belief in bulk handling of wheat, and of the States as far as possible arriving at uniformity in regard to the disposal of primary products generally. Other affirmations favoured—

The establishment of Dairy Advisory Committees in each State, and the appointment of an Interstate Committee to co-operate with the State Committees.

The facilitation of stock exchanges from State to State without surrendering the rights of a State to protect its own herds.

The uniform raising of horse-breeding standards on the lines of the Victorian and Tasmanian statutes governing same.

Uniformity respecting the official testing of pure bred dairy herds.

Closer supervision over the quality of dairy produce, and the encouragement of greater consumption of dairy products.

The compulsory registration of storage premises for dairy products.

A uniform examination standard for (*a*) milk and cream testers; (*b*) certificates (*c*) interstate reciprocity in regard thereto.

A recommendation to interstate steamship companies to extend their refrigerated accommodation; and to all shipping companies providing refrigerated space, including Commonwealth shipping line, that, as a matter of urgent necessity, a reduction in the cost of freight for refrigerated cargo be made.

Seed Wheat for Disposal.

AT HERMITAGE STATE FARM.

This Department has been experimenting for a number of years with several varieties of wheat as a result of crossbreeding and selection work at Roma State Farm; some have consistently given satisfactory results, very often under adverse conditions. These are now being offered to wheatgrowers, in order that they may have the opportunity of acquiring seed of varieties which have been tested and found suitable to soil and climatic conditions in the wheatgrowing districts of the State.

Orders for the undermentioned varieties (which are illustrated and described elsewhere) should be directed to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Remittance must accompany order, and, in the case of cheques, should have exchange added.

The price quoted for any of the varieties offered is 11s. per bushel, f.o.b. Hermitage.

VARIETIES.—"Inglewood," "Patriot," "The Prince," "Gundi."
(*See* accompanying illustration of three of the varieties.)

In addition to the above a limited quantity of "Amby" is also available at the same price.

Inglewood.—Mid-season variety. This is derived from a cross between Bunge and Federation Wheat, and has given consistent results in the South-Western wheat areas. The plant is of medium height, and on strong soils is inclined to carry a fair amount of flag. It stools well and possesses a straw of medium strength. Heads are of medium length, slightly tapering; non-bearded. The chaff is smooth and light-brown in colour. Grain of medium size, somewhat elongated in appearance; semi-translucent.

Patriot.—Derived from a selection made after crossing Bunge and a Durum wheat. A mid-season variety, of moderate stooling habit. Straw is of medium height and somewhat tough. Flag scanty. Head tapering, non-bearded, open appearance, and of medium length. Chaff smooth and of a pale-golden colour. Grain somewhat short; full-bosomed; semi-translucent.

"Inglewood." "Patriot." "The Prince."

PLATE 27.—SEED WHEAT FOR DISPOSAL.

The Prince.—A selected crossbred wheat; early mid-season variety, of fairly tall-growing habit, suitable for main-crop sowing. A good stooler, and carries very little flag. Head of medium length, open appearance, slightly tapering; non-bearded. Chaff smooth and of a pale-golden colour and somewhat closely attached to the grain, which is plump, full-bosomed, semi-translucent, and of medium hardness. Fairly resistant to rust.

Gundi.—A selection from a Bunge-Federation cross. A mid-season variety suitable for early sowing, of moderate stooling habit. It carries a medium amount of flag. Straw moderately stout and slightly under medium height. Head long and compact. Chaff smooth and light-brown in colour. Grain medium-sized; somewhat rough skinned; white in colour. This variety has given a yield of 37.2 bushels at Roma State Farm. More suited for Western and South-Western conditions than for the Downs.

Amby.—A popular variety suitable for main-crop sowing. It is a hardy mid-season variety and a good stooler, carrying a moderate amount of flag. Ears compact, non-bearded; chaff white and smooth. Grain plump and rather shotty in appearance; semi-translucent. Is an excellent milling wheat and has given good results in the principal wheat-growing districts.

AT STATE FARM, ROMA.

The following varieties of Seed Wheat are available for distribution from Roma State Farm. Price 11s. per bushel; free on trucks, Bungeworgorai:—

"Amby." **"Bunge No. 1."** **"Soutter's Early."**

Limited quantities of the following new wheats are also available at the same price:—

"Cedric." **"Inglewood."**

In the event of farmers desiring to have small quantities not exceeding 1 bushel of new varieties of Roma Crossbreds for trial this season, arrangements for their purchase may be made with the Manager at the same rate—*i.e.*, 11s. per bushel, free on trucks, Bungeworgorai.

Remittance, with exchange added, should accompany order, and be sent direct to the Manager, State Farm.

Pastoral.

THE SHEEP MAGGOT FLY PROBLEM IN QUEENSLAND.

By PROFESSOR T. HARVEY JOHNSTON, University, Brisbane.

The sheep maggot fly problem in Australia, as well as in New Zealand, South Africa, Great Britain, and elsewhere, has no doubt been brought about by some disturbance of natural conditions. Blowflies normally deposit eggs or larvæ in carrion, but for some reason several of our native Australian species have adopted the habit of "blowing" living sheep. Apparently the soiled wool on the crutch gives off certain odours which have an attractive influence on the gravid female flies, leading them to deposit their offspring in the position indicated. It is quite possible that one or more kinds of flies initiates the attack and sets up such a condition as leads to infestation by other blowflies. Associated with this "myiasis" there is an alteration of the animal's health—partly from the irritation caused by the presence of the maggots, partly from the destruction of tissues and the invasion by germs of various kinds—a more or less pronounced fevered state being observable. Not infrequently death is the result. At times, even a mild invasion by maggots is very rapidly followed by the death of the animal, such being probably due to septicæmia or blood poisoning.

It has been estimated that the annual loss of sheep, due to natural causes (old age, lambing, disease, and accidents) is about 5 per cent., and that the losses as a result of fly attack in Queensland also average about 5 per cent. If these figures be approximately correct, then one can realise quite readily what an enormous loss is being inflicted annually on one of our great primary industries. It is a serious mistake to imagine that the pastoralist is the only person affected. A diminution of the wool yield must adversely affect the shearer, carrier, and others in the country dependent on the wool industry. State and Commonwealth returns from both land and income taxation, also Crown rents and railway receipts, must become reduced. Shipping interests suffer, and so also do city life and business. The matter is then not merely one affecting only a section of the community, but is truly national, particularly in this State and in New South Wales.

The problem can be attacked from two sides, either biologically or chemically, the former being concerned especially with the fly and the latter with the sheep. The application of certain poisonous chemicals—either as dips, jets, sprays, showers, washes, &c.—to sheep will not destroy fly preponderance; the aim being (1) to destroy any maggots already infesting an animal, and (2) to protect it from fly attack. Excellent work along this line of investigation has been carried out at Dalmally by the Queensland Blowfly Committee of the Institute of Science and Industry, ably assisted by Mr. W. A. Russell. A great many medicaments have been tried, but it has been ascertained that only those containing not less than a certain percentage of arsenic are of use. However successful the chemical attack may be, it must be remembered that this method of control must be continued year after year and involves a good deal of expense in regard to equipment and labour especially.

The biological side of the investigation aims at studying the flies and their controlling agents, so that there may be not only less opportunities for flies to breed (by destroying their ordinary breeding places), but also less flies actually developing from the eggs and maggots laid by the adult female fly, this latter result to be brought about by the use of such natural enemies (*e.g.*, certain wasps) as parasitise and destroy them while the flies are still in the maggot or pupal stage. Biological methods, if successful, lead to a reduction of the pest to such a state that a certain balance becomes established between the blowflies and their parasites, whereby the former are controlled. Continued expenditure should then not be necessary, unless for some reason, natural conditions favoured the flies rather than the parasitic wasps and other organisms which live at their expense.

The writer does not claim to possess special knowledge of the problem in the field, but for the past few years a considerable amount of investigation has been carried out under his guidance in the biological laboratory at the University, Brisbane, where the life history of the various flies and the different wasps which infest and destroy them has been studied.

Since practically all the work has been carried out in Brisbane, it is not safe to assume that similar results will necessarily be obtained in the western part of Queensland. A great deal of research has already been carried out in New South

Wales under the superintendence of Mr. W. Froggatt, who, with his colleagues, has also been actively engaged in studying the sheep maggot fly problem, but in order that our local knowledge may be more satisfactory and useful, similar as well as additional investigations should be undertaken in this State, especially in some pastoral centre.

Available evidence seems to incriminate one kind of fly especially as the sheep maggot fly—a medium-sized, bluish green blowfly, usually called *Pycnosoma* (or *Chrysomyia*) *rufifacies*. In other countries the culprit is a somewhat similar fly generally called *Lucilia*. We have in Queensland abundance of this latter copper-coloured and greenish blowfly, and it is advisable to consider it when dealing with our local problem. In fact, it is probably unwise to exclude any of the local blowflies in the present state of our knowledge.

In May, 1920, the writer was asked to outline a scheme of work in connection with the biological side of the inquiry, to be carried out at Dalmally, near Roma, where Mr. Russell is actively co-operating with the Queensland Blowfly Committee. In order to be more familiar with local conditions, a visit was paid to Dalmally, and then a scheme was planned, submitted to, and accepted by the committee. The Institute of Science and Industry also approved of it, but the matter was allowed to stand over until the Director should be appointed. No doubt a forward move will now be made by that body.

The scheme of work in Queensland in connection with the attempted biological control falls under two headings (*a*) measures against the adult fly, and (*b*) those which aim at destroying the larval or pupal fly. Measures designed (*c*) to destroy maggots already infesting sheep, and (*d*) to prevent sheep from being attacked, more properly belong to the chemical side of the investigation.

The plan submitted called for work along the following lines:—

A. *The Adult Fly.*—

1. Exact knowledge as to the various kinds of blowflies which frequent sheep, especially those which breed in wool on sheep.
2. Does any particular species initiate the conditions and become the means whereby others may be induced to attack infested animals?
3. Determination of factors (if any) which predispose to fly attack.
4. Seasonal prevalence of the different kinds.
5. Locality prevalence of the various species,—*i.e.*, what classes of country does each prefer?
6. Testing of various traps and baits; also poison bags.
7. Range of flight from known breeding places.
8. Enemies of adult flies—*e.g.*, "policemen flies" and various other wasps, certain beetles, &c.

B. *Measures against larval stages.*—

9. Determination of breeding places other than wool.
10. Study of the biology of each species, especially the ascertaining of the period elapsing between the deposition of eggs or maggots by the female and the emergence of the adult fly.
11. Use of the various chalcids. This involves a careful study of the chalcids themselves.

There are many species of blowflies to be met with in the vicinity of Brisbane, and most of them occur in our sheep country as well. The following is a list of the more important of them, but a few of those mentioned breed readily in decaying vegetable matter as well as in carrion. Many of the species have been bred from living sheep and wool:—

(1) The sheep maggot fly or hairy maggot fly, *Chrysomyia rufifacies*, often called *Pycnosoma rufifacies*. This is a fairly large species of a fine bluish-green colour. The larva is characterised by the presence of a number of prominent processes on each segment—hence the name "hairy maggot." The darkly coloured pupa also possesses tubercules, though they are much smaller than those of the maggot.

(2) The small hairy maggot fly, *Microcalliphora varipes* (or *Pycnosoma varipes*) which more or less resembles No. 1 in colour and in regard to the structure of its larval and pupal stages, is a much smaller fly, being about the size of an ordinary house fly.

(3) The so-called green bottle or blue bottle flies (species of *Lucilia*), which are of about the same size as No. 1. Though they are also bluish-green they usually differ from the foregoing flies in possessing a bronzed colouration on parts of the body. Though the name *Lucilia sericata* is generally applied, it is almost certain that several distinct species are included under that term in Australia. The maggots are relatively smooth, as also are the rather thin red-brown pupæ, consequently being in marked contrast to those of the two species mentioned previously.

(4) A deep blue blowfly, rather larger than any of those already mentioned. It is called *Chrysomyia dux*, but has been referred to frequently as *Lucilia tasmaniensis*. This handsome fly is very common during the late summer and autumn in Brisbane, and is readily attracted to meat. Its relation (if any) to sheep in Australia has not been ascertained, but it is regarded as being a sheep maggot fly in the Hawaiian Islands.

(5) *Chrysomyia incisuralis*, a fly resembling the latter in size and general colouration but differing in its abdominal markings. The habits of this rather uncommon fly are not well known.

(6) *Neocalliphora ochracea*, a large reddish-brown blowfly of whose habits little is known. It is not common in Brisbane.

(7) *Paracalliphora augur*, often called *Calliphora oceaniæ*. This is a common blowfly in the vicinity of houses, and is characterised by its dark slate-coloured thorax, and by the dark-bluish broad band down the middle of the abdomen, whose sides are brownish yellow.

(8) *Neopollenia stygia*, sometimes called *Calliphora villosa*. This is also a common house blowfly, "the golden haired blowfly." It somewhat resembles the last-mentioned fly but the abdomen is more or less uniformly yellow-brown in colour.

(9) *Synthesiomyia brasiliana*, a fly with large, prominent eyes and with a reddish-coloured tip to its abdomen. Otherwise, this carrion fly resembles an oversized house fly in its colouration and markings.

(10) *Muscina stabulans*, a grey fly somewhat like a long-winged house fly in general appearance but with the thoracic stripes much less obvious. This species breeds readily in decaying vegetation as well as in carrion.

(11) The small shining black blowfly, *Ophyra nigra*. This is about the size of a house fly and is extremely common in Southern Queensland. It readily visits carrion and is regarded as one of the sheep maggot flies.

(12) *Ophyra analis*, an uncommon fly which differs from the last-named in possessing a lighter-coloured tip to its abdomen.

(13) The various flesh flies—species of *Sarcophaga*—of which about twenty are known from Brisbane. These range in size from a house fly upwards, the larger species being much bigger than any of the blowflies mentioned above. The flesh flies are characterised by the possession of three obvious black stripes on the back of the thorax, the intervening part being greyish, silvery, or golden. These flies breed very readily in carrion. Some act as parasites of locusts, &c., which are destroyed by the developing fly larvæ.

(14) One of the two commonest English blowflies, *Calliphora erythrocephala*, occurs in Sydney, but the writer has not yet observed its presence in Queensland.

Detailed observations have not been published regarding to life history of these various flies in Queensland. Nos. 1 and 2 are abundant from December to March in Brisbane; Nos. 3 and 11 are common all the year round; No. 4, from March to May and probably later; No. 7, especially during winter and early spring; No. 13, abundant especially during late summer and autumn. There is little doubt that the rainy season has a very marked effect on period of occurrence of the various species.

The following summary of results regarding some of the above-mentioned blowflies is now made public. The work has been carried out by Mr. O. W. Tiegs, M.Sc., and myself, in the University biological laboratory. My remarks relate to Nos. 1, 2, 3, 7, 11, and 13.

Eggs hatch out in the case of the most important of these in from 17 to 19 hours (Nos. 1, 2, 3). The flesh flies are larviparous, while some of the other blowflies are also at times. The larvæ feed for a period of from three to about six days in the case of the six kinds of flies mentioned. Then there follows a period of variable duration during which the larvæ do not feed and are preparing for the next stage, the pupal condition. This period of relative inactivity extends from one to four or five days, according to the weather (Nos. 1, 2, 3, 7). *Ophyra* (No. 11) and *Sarcophaga* (No. 13) take much longer, viz., from 10 to 25 in the former case, and 10 to 12 in the latter. Thus the total larval period (maggot stage) ranges from 4 to 8 days in the first group; 15 to 30 for *Ophyra;* and 15 to 17 for *Sarcophaga*. The pupal condition occupies from 4 to 8 days in Nos. 1, 2, 3, 7; from 8 to 20 in Nos. 11 and 13. Thus the number of days elapsing between the deposition of the egg or larva by a female and the emergence from the pupa is from 9 to 14 days in the case of the three bluish-greenish metallic flies (Nos. 1, 2, 3), and from 19 to 40 days for the others (Nos. 7, 11, 13). The longevity of adults bred and maintained in captivity in Brisbane was found to be from 13 to 30 days, usually about 20. It is not known how long they live under natural conditions.

An important part in regard to fly control is doubtless being played by the various wasp parasites which destroy flies while they are in the pupal condition, though the attack may be made during the maggot stage. There are at least eight such wasps now known to occur in Eastern Australia:—

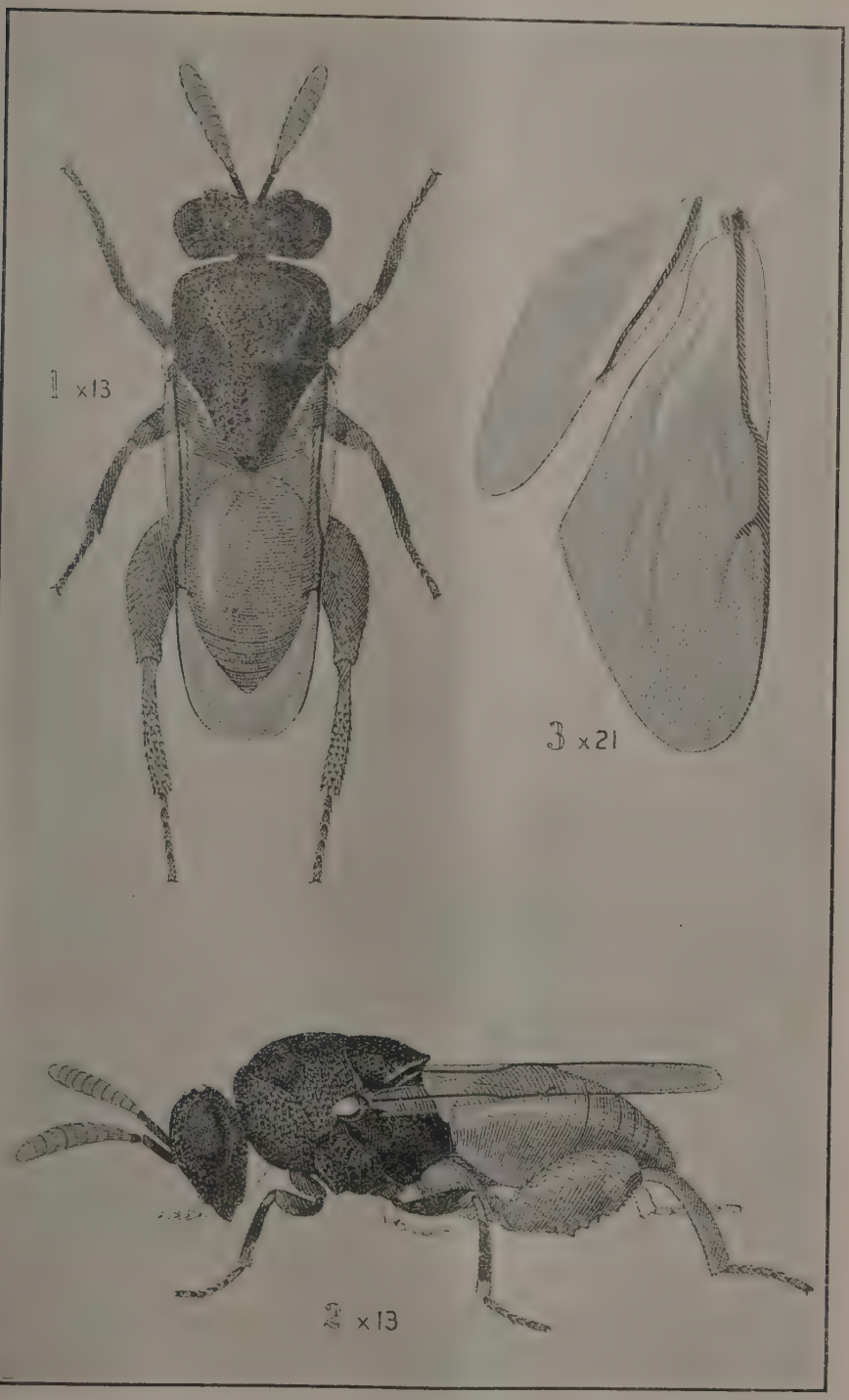


PLATE 28.—A NEW PARASITE ON SHEEP MAGGOT FLIES.

1. Dorsal view of *Chalcis calliphoræ*. 2. Side view of same.
3. Enlarged view of one of the wings.

(1) A tiny ant-like wasp of a rich metallic colour, *Nasonia brevicornis*, known generally as "the chalcid wasp" to sheepmen. It has been bred up and distributed in Queensland and New South Wales in order to assist in the fight against blowflies. In our laboratory, it was found that about 14 days elapsed between the time of oviposition of a female into a fly pupa, and the date of emergence of the wasps after having destroyed the fly. The female lays a varying number of eggs (generally about 20) in each pupa. The habits of this interesting little insect have been carefully studied by Mr. Froggatt and his colleagues in New South Wales.

(2) A small "digger wasp" (*Dirhinus sarcophagæ*) which occurs in New South Wales and Queensland, behaves somewhat like *Nasonia* as a destroyer of blowfly pupæ, except that only one wasp emerges, as a rule, from each parasitised pupa. It requires 28 days in Brisbane to develop from the egg to the emerging insect.

(3) A black ant-like wasp, *Spalangia muscidarum*, has been found to need from 21 to 28 days for its development from the egg deposited in a fly pupa to the emergence of the insect. This parasite attacks a considerable number of different flies, such as house and bush flies, stable flies, blowflies, and flesh flies. Only a single wasp emerges from each infested pupa. The species is known from Brisbane, Roma, and Eidsvold in our State. I have also seen specimens in the National Museum, Washington, U.S.A., bred from houseflies in Adelaide and sent over by Mr. A. M. Lea for determination.

Several other species of *Spalangia* are known from Queensland, having been described by A. Girault, but nothing is known regarding their habits.

(4) Another chalcid parasite of blowflies—one which attacks the maggot stage—has been named *Chalcis calliphoræ* by Mr. Froggatt. It appears to be quite uncommon. We have obtained it on only one occasion in Brisbane. Its rarity suggests that it is not an important enemy.

(5) An *Encyrtid* wasp parasite, discovered by us in Brisbane last year, differs from all the others referred to in this list except No. 4 in that it readily attacks the larval stages of blowflies, laying eggs in the maggot, which subsequently pupates but is destroyed in the pupal stage, a number of wasps emerging from each parasitised pupa in about 21 to 23 days after the eggs have been deposited. The wasp is more or less reddish-brown in general appearance, while its size is about that of *Nasonia*. The *Encyrtid* is now being bred up in the University laboratory as it promises to be a very important insect in the biological campaign against the sheep maggot fly. It should be tried in conjunction with such forms as attack pupæ, *e.g.*, *Nasonia* and *Spalangia*.

(6) A much larger shining black wasp, about quarter of an inch in length, called *Hemilexomyia abrupta* has been found in New South Wales to attack certain of the sheep maggot flies, but is not there regarded as of much importance owing to its rarity. We have not yet recognised its presence in Queensland.

(7) There were bred out from blowfly pupæ in Brisbane on one occasion, small Diapriid wasps related to, but quite distinct from, the last-named.

(8) A small wasp-like insect, *Pachycrepoidens dubius*, known to destroy house flies, has been recorded from North Queensland. Its effect, if any, on blowflies is not known.

Of the eight wasp parasites of flies mentioned above, four (Nos. 1, 2, 4, 6) have been studied by Mr. W. Froggatt in New South Wales; and six (Nos. 1, 2, 3, 4, 5, and 7) by ourselves in Brisbane. The writer endeavoured to obtain in England a consignment of pupæ parasitised by a comparatively large Braconid wasp, *Alysia manducator*, which attacks blowfly maggots, deposits an egg in each, the resulting wasp emerging from the fly pupa. Owing to the time being midwinter, the project was not successful. In regard to fly control by those wasps which attack pupæ, it must be remembered that the accessibility of the pupæ to wasp parasitism is a very important factor. If maggots pupate in situations out of reach of *Nasonia*, &c., then they are safe. We found in Brisbane, in our experiments, that not more than 4 per cent. of the maggots pupated on the surface of the soil, even when under shelter, the remainder burrowing for varying depths into the soil before coming to rest. This fact, if generally true, greatly limits the usefulness of *Nasonia* and other wasps with similar habits. Those which attack maggots, on the other hand, would have much more opportunity to bring about infestation, owing to the wandering habits of the fly larvæ.

From the foregoing article it will be seen that, though a considerable amount of investigation has been carried out in New South Wales by Mr. Froggatt, and by ourselves in Brisbane, yet much remains to be done, especially in the field in Queensland sheep country. There is certainly urgent need for the services of a fully qualified investigator to assist in the attempted biological control of this serious blowfly menace. It would probably be advantageous for such research worker to collaborate with the University biologists.

THE BLOW-FLY PEST.

DEMONSTRATION AT DALMALLY.

The work of the Special Blowfly Committee, appointed by the Commonwealth Institute of Science and Industry, commenced at Dalmally Station, near Roma, in February, 1918. This work was an extension of earlier activities of the Department of Agriculture and Stock towards checking the ravages of the blowfly in the flocks of the State at Gindi under the direction of Mr. W. G. Brown (Sheep and Wool Expert).

The operations at Dalmally started on a few hundred sheep, and were gradually extended to the treatment of a flock of 14,000. The apparatus employed included a power dip, power spray, and jetting plant.

The committee received valuable assistance and co-operation from Mr. Russell. The work and life history of the Chalcid wasp, a natural enemy of the blowfly, discovered by Mr. Edmund Jarvis (Entomologist, Sugar Experiment Station, Meringa), at Talleyrand, near Longreach, in October, 1913, were also closely studied.

The experiments were carried out by (*a*) the use of poisonous dips treating the whole body of the sheep; (*b*) the application of poisonous dip mixtures by a strong jet directed to the breech of the animal treated; (*c*) the use of other likely dressings applied only on the breech of the sheep; (*d*) the application of arsenate of soda alone in a comparatively strong solution by dipping and jetting; (*e*) the use of soap and water in the form of a washy solution instead of poisonous dip mixture; and (*f*) endeavour by means of traps or poisonous baits to reduce the number of flies.

The soap and water solution proved a failure and the fly-trap method was not found very satisfactory.

As the circumstances under which the experiments were carried out were not altogether favourable, further experiments will be continued under the direction of Professor T. Harvey Johnston, M.A., D.Sc., of the Queensland University.

Samples of wool taken from the treated sheep were tested from time to time to ascertain the quantity and effect of arsenic in the wool and if its handling is harmful to the shearer.

The members of the committee are Messrs. S. P. Fraser (representing pastoralists), chairman, W. G. Brown (State Sheep and Wool Expert), J. B. Henderson (Government Analyst), and Major A. H. Cory (Chief Inspector of Stock), with Miss Todd as secretary.

THE DEMONSTRATION.

On Friday, 13th May, a demonstration of the spraying, dipping, and jetting processes was conducted at Dalmally in the presence of Mr. G. H. Knibbs, C.M.G. (Director of the Institute of Science and Industry), Professor T. Harvey Johnston, the Blowfly Committee, and about 200 representative graziers and others interested in pastoral pursuits. Representative visitors from other States were included in the gathering. Mr. W. G. Brown controlled the operations.

The proceedings opened with a general inspection of the plant, followed by an explanation of the several processes by Mr. Brown.

The dip specifics used were mixed mechanically, the power being supplied by a gasoline engine of 5-h.p. generating a pressure of 200 lb. It was explained that 100 lb. to 120 lb. pressure was sufficient for ordinary purposes. The liquid was conveyed by pipes to the various dips and troughs in use. The simplicity and effectiveness of the installation were favourably commented upon.

At the conclusion of the preliminary inspection of plant and lay-out, Mr. S. P. Fraser detailed the history of the efforts that have been made to combat the pest and of the investigations and experiments that followed. Professor T. Harvey Johnston lectured on the pest and the result of efforts made to check its ravages. His remarks are covered by a special paper on the subject printed elsewhere.

After luncheon, practical demonstrations of the processes found most effective were entered upon. The shower dip was the first brought into use. Sheep were driven into a long floored pen covered with a shallow perforated tray of the same dimensions of length and width. The dip mixture was pumped into the tray and fell like heavy rain on the sheep beneath. The shower continued for seven minutes, in which time the sheep became thoroughly soaked. The pen capacity is 100 sheep.

The next method illustrated was the swim-dip. The trough contained a mixture of sheep dip. The animals were forced along the race to the dip and in the course

of their 60 ft. swim were entirely immersed, two men operating alongside with crooks to ensure overhead immersion. This method was more rapid than the one previously demonstrated.

A pen of sheep was then subjected to the jetting process—first with a mixture of arsenic and sheep dip and finally with fine oil. The mixture in each instance was forced through a mechanically operated nozzle at a pressure of between 100 lb. to 120 lb. By this method only the breech of the sheep was treated; and it was explained that the process ensures immunity for a period of from two to four months. It was claimed that one man can treat in this way from 1,000 to 1,200 animals per day; besides being a preventative from blowfly attacks, it renders crutching unnecessary. This was the final operation, and the company then adjourned to the homestead lawn, where a number of interesting and informative addresses were delivered.

POINTS OF THE ADDRESSES.

Mr. W. A. Russell (Dalmally) detailed the measures undertaken and means adopted on his property to effectively combat the fly. The points he made were—

No sure preventative for a prolonged period has been discovered in the course of experiments extending over three years, but he claimed that a fly attack can be checked immediately by the jetting process, using strong arsenical mixtures which kills all maggots and arrests for a time further infestation.

Complete immunity may be secured for three or four months, but, generally, a virulent fly attack abates after a few weeks. Jetting outfits used immediately would prevent losses. On two stations the previous year, where no means were at hand to jet sheep in large numbers at the outbreak of a fly attack, the losses that followed exceeded those of the big drought. In each case the losses were estimated at 15,000 sheep all nearly fully fleeced.

So far non-poisonous specifics had proved valueless; the stronger the poison the greater the protection.

Results showed that a surprisingly small quantity of arsenic is retained in the wool. The difficulty was to "fix" sufficient arsenic in the fleece. Once it is "fixed" no insect life can exist in it. Arsenic does not appear to hurt sheep that are badly wounded, even if applied in strength up to 10 lb. per 100 gals. of water.

He intends trying a much greater strength with the object, in co-operation with the scientists on the Committee, of "fixing" arsenic in wool in such quantity as to give complete immunity, the sheep itself acting as a trap to the fly seeking to deposit its larvæ.

Jetting does away with the necessity for crutching, but, on the other hand, gives employment throughout the year.

Every specific that suggested a reasonable prospect of success was tried in the course of the Dalmally experiments. A non-poisonous compound was tried on 600 Dalmally sheep, and within a week half that number died. Another experiment with a poisonous specific resulted in the loss of fifty sheep. Analytical research was being made to ascertain the cause. Arsenic and other poisons were used on sheep in strength that hitherto would have been deemed fatal.

By analysis it has been found that some specifics are stronger in arsenical contents after having been used than before, showing that when jetting or dipping sheep with these mixtures the arsenic is not retained in the wool in equal proportions with the other ingredients; hence the reason for using all specifics stronger than would otherwise be necessary.

Jetting with poisonous dips with arsenic added costs about one-fifth of a penny per sheep.

It has been recognised that if arsenic could be dissolved in oil the difficulty would be easy, as the arsenic then would hold in the wool for a greater period; but to dissolve arsenic in oil appears to be a chemical impossibility.

An arsenic and oil mixture was tried, the arsenic being held in suspension as with all powder dips, and it appeared to act well. This process was, however, more expensive.

Reported Failures.—Jetting had, in some cases, been said to fail. This, in Mr. Russell's opinion, is only—(1) Where the arsenic has not been properly dissolved; (2) where the arsenic supplied has been of inferior grade. If anything, they were erring on the weak and careful side. Personally, he was using, or had used, specifics mixed with arsenic up to 10 lb. per 100 gals., but is not certain of its being sufficiently safe to recommend for general use.

Chalcid Wasps.—These insects, though seemingly a side issue, are a valuable factor in controlling the fly pest to a certain point. He thought they held the pest in check, although, when the fly is not very prevalent, the chalcid is also scarce. With the outbreak of a fly attack the chalcids soon appear in great numbers, and they seem to check the outbreak; or, what really occurs, a chalcid attack follows the fly, and reduces its numbers to normal.

All serious fly attacks appear to last only for a couple of months. He does not think that the local chalcid will ever destroy the fly completely, nor control it below a point harmful to the sheep, for both are indigenous and have been known for years. But if a chalcid were obtained from some other country it might prove more effective.

Each fly attack varies in its severity, according to the time of the outbreak and the species of fly prevalent at that particular period, in much the same way that grass and herbage varies according to the time that rain falls.

Trapping of the Fly.—He does not think that, from a practical point of view, this method is of the slightest value. The fly is very local, and the traps, to be in any way effective, would have to be every few hundred yards apart. They have their uses, however, in obtaining specimens of the various flies for scientific purposes, but the expense of attending and rebaiting are greater than their practical value.

Fly Fever.—This is a disease which appears in some seasons, and affects sheep as soon as struck, causing a very high temperature and great sickness, and comes with a very slight infestation. It is extremely dangerous, as blood poisoning sets in almost immediately. The affected sheep drop away from the mob and seek cover.

So far, the amount of money spent by the Institute is small, compared with the importance of the work.

Mr. J. G. Henderson (Government Analyst) said that by analysis it was found that arsenic adhered mainly to the butt and middle of the wool. In new wool its presence was greatest about the middle. He had found that the period of protection afforded by the jetting process was about three months. Mr. Russell's field experiments, backed by scientific research, had created an interest that must give rise to the co-operation of all concerned in a work of vast economic value.

Mr. W. J. Linton (Mount Abundance), representing the Scottish Australian Investment Company, strongly favoured the jetting process. A weak solution of arsenic was not effective. He had obtained excellent results from the mixture of 4 lb. of arsenic and 1 packet of dip specific to 100 gals. of water recommended as a result of the Dalmally experiments. He was so satisfied with the outcome of those experiments that jetting plants were now installed on all stations under his supervision. He had checked a serious outbreak of fly by this process, and was satisfied that it was the best method of dealing with the pest so far discovered.

Mr. W. G. Brown (State Sheep and Wool Expert) warned pastoralists of the existence of other pests besides the blowfly. He had noted the very rapid spread of stomach worm in sheep; and another parasite that required checking was the nasal fly.

Mr. G. H. Knibbs, C.M.G. (Director of the Institute of Science and Industry), said he was impressed with the force of observations made in the course of the day. The necessity of calling in chemistry and biology as aids to stockowners in preventing great economic losses was plainly realised. These losses had gone beyond the border of personal economics, and had become of national concern. Efforts to solve rural problems had national significance. He looked upon their scientists and others like Mr. Russell as performing a national service.

The Hon. Thomas Waddell, M.L.C., of Fort Bourke Station, New South Wales, said that he was much impressed by what he had seen. The blowfly pest is undoubtedly the most serious trouble sheep breeders have to fight, and it is now a vital matter to find out the cheapest and most effectual method of fighting the pest. The experience gained under the scientific and thorough methods adopted not only make for the discovery of the best specific, but, in a negative way, must do good by making known what chemicals are useless. Mr. Russell had done a great public service by allowing the experiments to be carried on at Dalmally. It is an ideal place for the work, and his thorough practical knowledge of sheep and keen intellect enables him to follow closely what the Committee is doing, and discuss with them every method that may be suggested for fighting the pest, and make him a valuable man. The method shown of wetting the sheep by a shower bath instead of subjecting them to the much rougher treatment of dipping was to him most interesting. Mr. Waddell concluded by saying that he felt well repaid for making the journey across.

PLATE 29.—VISITORS TO DALMALLY, ROMA, RESIDENCE OF W. A. RUSSELL, ESQ. (DEMONSTRATION OF THE VARIOUS METHODS OF DEALING WITH THE BLOWFLY PEST, 13TH MAY, 1921, UNDER THE AUSPICES OF THE COMMONWEALTH INSTITUTE OF SCIENCE AND INDUSTRY).

1. SPECIAL BLOWFLY COMMITTEE.—*Reading from left to right:* W. G. BROWN (State Sheep and Wool Expert); W. A. RUSSELL (Dalmally); G. H. NIBBS, C.M.G. (Chairman of Institute); S. P. FRASER (Chairman of Committee); Professor T. HARVEY JOHNSTON, M.A., D.Sc. (Queensland University); Major A. H. CORY (Chief Inspector of Stock); J. B. HENDERSON (Government Analyst).

3. The Jetting Process

5. Swim Dip.

4. Shower Dipping.

6 Jetting with Fine Oils.

2. General View of Yards.

PLATE 30.—DEMONSTRATION OF VARIOUS METHODS OF DEALING WITH THE BLOWFLY PEST AT DALMALLY, MAY 13TH, UNDER THE AUSPICES OF THE COMMONWEALTH INSTITUTE OF SCIENCE AND INDUSTRY.

Poultry.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, APRIL, 1921.

The weather conditions during the earlier part of the month were not such as could be desired for the commencement of a test. Rain fell during the first week, and was followed by westerly winds. There was one death, E. Chester having to replace his "A" bird in the light breed singles, the cause of death being rupture of the liver. There have been the usual mild troubles usually met with at the beginning of a test—viz., slight colds, cases of warts, and occasional ovarian disorders. There have been a few cases of moult, but not nearly so many as one would expect with birds sent in full lay as was the case with the majority which were very forward, and a number appeared as though they had been laying for a considerable time. The birds have been placed in the single pens as follows:—In the light section, "A" carries a white ring, "B" red, "C" blue, "D" green, "E" pink, "F" yellow. In the heavy breeds the colours are the same with the exception that "A" carries a black ring. The following are the individual records:—

Competitors.	Breed.	April.
LIGHT BREEDS.		
*G. Trapp	White Leghorns	125
*W. and G. W. Hindes	Do.	123
R. Gill	Do.	115
H. C. Thomas	Do.	112
F. Birchall	Do.	107
*Mrs. R. Hodge	Do.	104
R. G. Cole	Do.	99
W. A. Wilson	Do.	95
*J. Newton	Do.	94
*R. C. J. Turner	Do.	91
*C. M. Pickering	Do.	88
*C. Goos	Do.	84
*Haden Poultry Farm	Do.	84
*E. Chester	Do.	84
*H. C. Towers	Do.	83
*T. Fanning	Do.	79
*W. Becker	Do.	77
*T. Eyre	Do.	76
*H. Fraser	Do.	75
*J. M. Manson	Do.	74
O. C. Goos	Do.	73

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	April.
LIGHT BREEDS—*continued.*		
Oakleigh Poultry Farm	Do.	70
J. W. Short	Do.	69
Brampton Poultry Farm	Do.	69
*Thos. Taylor	Do.	67
W. Barron	Do.	65
*E. A. Smith	Do.	64
*W. and G. W. Hindes	Brown Leghorns	61
Mrs. E. White	White Leghorns	61
M. F. Newberry	Do.	59
*B. Chester	Do.	57
E. Stephenson	Do.	56
*S. L. Grenier	Do.	53
Mrs. E. Z. Cutcliffe	Do.	52
*S. Williams	Do.	50
Bathurst Poultry Farm	Do.	48
*Mrs. L. Anderson	Do.	45
W. H. Glover	Do.	35
*H. P Clarke	Do.	20
Linquenda Poultry Farm	Do.	19
H. Stacey	Do.	17
HEAVY BREEDS.		
T. Fanning	Black Orpingtons	130
Jas. Potter	Do.	118
W. Decker	Langshans	106
Jas. Avery	Do.	103
*R. Holmes	Black Orpingtons	102
*E. Morris	Do.	102
*T. Hindley	Do.	99
Rev. A. McAllister	Do.	87
*H. M. Chaille	Do.	85
*Parisian Poultry Farm	Do.	83
*A. E. Walters	Do.	83
*E. Stephenson	Do.	80
Jas. Ryan	Rhode Island Reds	76
G. Muir	Black Orpingtons	76
*R. Burns	Do.	74
*J. Ferguson	Chinese Langshans	72
*E. F. Dennis	Black Orpingtons	62
G. Cumming	Do.	56
*C. C. Dennis	Do.	47
*J. Cornwell	Do.	35
*E. Oakes	Do.	31
*Mrs. G. Kettle	Do.	28
J. W. Newton	Do.	25
*A. Shanks	Do.	20
*N. A. Singer	Do.	19
*J. E. Smith	Do.	17
Tom C. Hart	Do.	8
F. Harrington	Rhode Island Reds	6
Total		4,809

* Indicates that the pen is being single tested

DETAILS OF SINGLE PEN TESTS.

Competitors.	A.	B.	C	D.	E.	F.	Total.
LIGHT BREEDS.							
Geo. Trapp	19	19	22	22	22	21	125
W. and G. W. Hindes	22	19	19	22	22	19	123
Mrs. R. Hodge	17	21	19	14	19	14	104
J. Newton	17	21	19	6	19	12	94
R. C. J. Turner	17	11	10	15	19	19	91
C. M. Pickering	21	15	13	7	21	11	88
C. Goos	18	22	1	10	8	25	84
Haden Poultry Farm	14	16	12	13	10	19	84
E. Chester	11	19	12	14	14	14	84
H. C. Towers	19	16	12	?	16	18	83
T. G. Fanning	18	11	14	12	11	13	79
W. Becker	13	10	14	13	18	9	77
T. Eyre	16	0	21	11	13	15	76
H. Fraser	22	7	9	1	19	17	75
J. M. Manson	6	21	14	7	18	8	74
Thos. Taylor	11	17	11	1	9	18	67
E. A. Smith	20	10	13	2	5	14	64
W. and G. W. Hindes	11	4	16	18	12	0	61
B. Chester	1	12	16	10	10	8	57
S. L. Grenier	3	18	3	16	11	2	53
S. Williams	23	8	1	2	7	9	50
Mrs L. Anderson	10	9	5	3	14	4	45
H. P. Clarke	20	0	0	0	0	0	20
HEAVY BREEDS.							
R. Holmes	19	18	15	16	20	14	102
E. Morris	20	21	13	19	10	19	102
T. Hindley	21	19	19	13	17	10	99
H. Chaille	0	23	14	25	23	0	85
Parisian Poultry Farm	1	20	19	22	7	14	83
A. E. Walters	8	19	11	14	10	21	83
E. Stephenson	12	7	19	11	12	19	80
R. Burns	5	13	25	2	20	9	74
J. Ferguson	15	16	1	13	13	14	72
E. F. Dennis	0	13	2	12	12	23	62
C. C. Dennis	12	0	0	14	17	4	47
J. Cornwell	6	4	7	7	6	5	35
E. Oakes	0	17	0	14	0	0	31
Mrs. G. Kettle	0	8	14	0	0	6	28
A. Shanks	0	0	0	12	8	0	20
N. A. Singer	3	2	0	0	0	14	19
J. E. Smith	12	5	0	0	0	0	17

CUTHBERT POTTS,
Principal.

QUALITY OF JIBBINBAR ARSENIC.

Investigation into the cause of certain parcels of arsenic despatched from the State mine at Jibbinbah being of inferior quality have shown that several casks had been filled from the first door of a flue, the arsenic from which, in the ordinary course, would have been returned to the furnace for further treatment. By an oversight those casks had been sold and sent away. When the Minister for Mines ascertained what had occurred, he took steps to trace, and, if possible, recover the casks in question. One had been found at Mackay, and was replaced, while two had been discovered at Maryborough. It was probable that one or two other casks of the inferior arsenic had been distributed, and he hoped to recover them also. As has been previously pointed out, all the arsenic is now analysed, and it has proved to be of high quality. Advantage had been taken of a temporary breakdown to "clean up" the furnaces at the State mine, the result being 50 tons of arsenic of very good quality.—"Queensland Government Mining Journal."

Dairying.

THE DAIRY PRODUCE ACT.

"*The Dairy Produce Act of* 1920" is now in force. A number of the provisions of the former Act are incorporated in the new Act in an unchanged form. Others have been amended, and requirements not covered by the 1904 Act have been added. Particulars of the more important matters provided for are summarised herein, but those directly engaged in the manufacture of dairy produce would do well to closely study the Act itself, in order to get a thorough grasp of its provisions.

The new Act requires the registration of all factories engaged in the manufacture of dairy products, and, *inter alia*, makes the grading of all milk or cream received by factories obligatory. The admixture of milk or cream of different quality is not permitted. Dairy produce must be packed under a registered brand, which should indicate the quality of the product. Particulars of the churn date and number of boxes from each churning must be shown plainly on each package; the date of manufacture and batch number is to be marked on each cheese manufactured, and on the crates containing the cheese.

The distribution of over-run has been provided for, and this provision will take effect from 1st July, 1921.

Advice cards, in the form prescribed by the Act, must accompany every consignment of butter and cheese forwarded to cold store, wholesaler, or dairy produce agent.

Under the Act all Queensland dairy produce is subject to examination and grading by an inspector. No dairy produce graded under the Act and cold stored may be drawn from storage without sanction by an inspector.

A return showing the particulars and complement of dairy produce manufactured, together with amount credited to suppliers, must be forwarded to the Under Secretary for Agriculture and Stock at given periods. The name and address of suppliers of milk or cream of indifferent quality to a factory in the course of the preceding month are to be sent to the Under Secretary at stated periods.

RECIPES FOR LIMEWASHES.

The following are recommended by the Department as suitable for milking-sheds, bails, stables, and all outside work, and particularly for roofs, to keep the buildings cool:—

No. 1.

20 lb. lime (unslacked),
3 lb. common salt.
½ lb. alum.

Slake the lime with boiling water until the consistency of the Wash is similar to thin cream. To increase its antiseptic properties, add ½-pint of crude carbolic to each bucketful of Wash.

No. 2.

To half a bucket of lime add two handfuls of common salt and two handfuls of tallow. Slake slowly with cold water, stirring all the time.

This quantity will make two bucketsful of Wash, which will possess the properties of being very adhesive and unaffected by rain.

No. 3.

Slake lime with water and add sufficient skim milk to bring it to the thickness of thin cream. To each gallon add 1 oz. of salt and 2 oz. of brown sugar or molasses dissolved in water.

The germicidal value of Nos. 2 and 3 can be increased by the addition of ¼-lb. of chloride of lime to every 30 gallons of Wash.

Before applying the Wash to wooden, metal, or stone structures, precautions should be adopted to clean the surface of foreign matter, thereby increasing the benefits of the solution. Care should also be taken to bring all crevices under the influences of the antiseptic.

For inside work in dairies and factories, with damp atmospheres, whitewashes should not be used, but the buildings should be painted with reliable sanitary paints.

The Orchard.

QUEENSLAND DATES.

By A. H. BENSON, Director of Fruit Culture.

Although the date is undoubtedly the most valuable fruit of the hot arid parts of the world, as it not only forms a very important part of the food of the inhabitants thereof but is also exported in large quantities, its culture on commercial lines has not so far been attempted in Queensland, despite the fact that the Date Palm thrives well here and large areas of our dry and hot western country are admirably adapted for its culture when a good supply of suitable water is available. The Date Palm thrives best in a deep sandy loamy soil such as occurs in large areas in our western districts, and it will not only withstand the heat but thrives on it, provided its roots are kept well supplied with moisture.

The Date Palm is diœcious—*i.e.*, the male flowers are produced on one palm and the female flowers on another, and this is probably the reason that one seldom meets with perfect fruit in this State, as the majority of the dates that have been submitted to me from time to time are infertile—*i.e.*, the flesh is very thin and of poor quality and the seed is undeveloped.

Some two years ago when visiting the Charleville district I found fully developed seeds underneath bearing Date Palms growing in that district, and was informed that the fruit from which the seeds had been derived had been fertilised by shaking the pollen from the male inflorescence over female flowers.

Last year Mr. George Espie, of Charleville, sent me some perfect fruit which was of exceptional quality. The fruit had a thick flesh, of a tender nature, and a comparatively small stone, and belonged to the type of the roundish-oval soft dates. The fruit was excellent when fresh, but I had no opportunity of determining its value for drying purposes.

There are many varieties of dates, which vary considerably both in the shape, texture, quality, and size of the fruit, as well as in the size and shape of the seed, but the dates sent by Mr. Espie would undoubtedly rank as first-class table fruit.

A photograph of a date tree in full bearing from Mr. H. J. Walton, photographer, Charleville, who informed me that the tree was grown by Mrs. Matthias, of Charleville, and was the same one from which the dates forwarded to me by Mr. Espie were taken, is reproduced herein.

The following information has been supplied by Miss J. Matthias in reply to my inquiries:—

"The palm tree shown in the photograph is seventeen years old, and was raised by chance from a seed, and has borne fruit since it was seven years of age. It bears annually a crop of from 12 to 13 bunches."

This is an excellent return and compares very favourably with that obtained from the date palms grown in Northern Africa and the Persian Gulf area.

The illustration gives a good idea of a bearing Date Palm and shows how well adopted our western country is for the production of this fruit. Should anyone purpose growing this fruit commercially it would be interesting for him to know that the palms are raised either from seed or from suckers that come away from the base of a bearing plant. In the case of the former, it is uncertain whether the resultant plant will be a male or female, consequently if seedlings are planted out there will be in all probability at least half males, but there is no certainty as to quality, a large number of inferior sorts resulting from the growth of seedlings. On the other hand, when suckers are taken from the base of a bearing plant all females will be obtained, and the quality of the fruit will be equal to that of the parent palm. Great care, however, must be taken in removing the suckers from the bearing palm, as they should not be removed until they are at least two or three years old and well rooted. They are then carefully removed from the bearing plant and put out in their permanent position, where they are kept regularly watered every two or three days until they have become well established. The only irrigation necessary once they are established is to apply sufficient water to maintain the requisite quantity of moisture in the soil for the proper development of the plant.

In setting out a plantation, the palms should be about 30 feet apart and there should be one male palm to twenty females, as the one male palm will be able to supply a sufficient quantity of pollen to fertilise the bunches of twenty female plants.

PLATE 31.—DATE TREE IN FULL BEARING WITH RIPE FRUIT, CHARLEVILLE.

STRAWBERRY CULTURE.

By ALBERT H. BENSON, M.R.A.C., Director of Fruit Culture.

Although the strawberry is commonly considered to be better adapted to the climate of the temperate zones than to that of the semi-tropics, it is, nevertheless, the one berry fruit which can be grown to perfection in this State. Excellent fruit is produced in our Southern coastal districts and even under tropical conditions such as those existing at Townsville, when the plants are grown on alluvial soil and are well irrigated. This shows that the strawberry has a wide range in this State and that it can be grown successfully over the greater portion of our Eastern coastline and the tableland country adjacent thereto, provided there is either an adequate rainfall or, failing that, a supply of water for irrigation.

The commercial cultivation of the strawberry is, however, confined mainly to those districts possessing a regular rainfall, and extends from the Redlands Area in the South to Bundaberg in the North. When grown under suitable conditions in this district, the strawberry has proved itself to be an early and prolific bearer, able to stand a fair amount of hardship, in the shape of dry weather, and to resist the attack of insect and fungus pests to a greater or less extent.

There is a good demand for the fruit, either for immediate consumption in this and the Southern States or for conversion into jam, and, as few crops yield a quicker return, it frequently enables a beginner to make a living whilst more slowly maturing fruit crops are coming into bearing. Many a pioneer fruitgrower has to thank the strawberry for his start, as it enabled him to make a living where he would, in all probability, have failed otherwise, and what applied in the case of our pioneers still holds good with the beginners of to-day.

Our strawberries are of excellent quality and carry well, so that they reach their destination in the Southern States in good order when carefully handled and packed, provided the weather is not excessively warm or the fruit over soft on account of excessive rainfall. The fruit is very suitable for jam, and the product of some of our local factories is not excelled elsewhere in the Commonwealth; further, the demand for strawberry jam exceeds the supply, so much so indeed that, for a considerable period of the year, it is not procurable. There is therefore room for the extension of the industry as the price realised for good strawberry jam in the Commonwealth should enable both producers and manufacturers to obtain a satisfactory return.

SOILS FOR STRAWBERRIES.

Given suitable climatic conditions, strawberries will thrive in most soils, but the ideal soil for this fruit is a rich loam of medium texture, well supplied with humus, possessing perfect natural drainage, and capable of retaining moisture during dry spells—and the nearer one can get the soil to this ideal the better the results. Heavy, cold, badly-drained soils are not suitable, but any good loam or sandy loam, whether of scrub or forest origin, can be made to produce good berries if properly treated.

PREPARATION OF THE SOIL.

There is only one way to prepare soil for strawberry culture, and that is, *thoroughly*. Nothing else will do. In the case of virgin scrub or forest land, which is, as a rule, fairly rich in humus, the land, after it is cleared, should be broken up deeply and brought into a state of as nearly perfect tilth as possible. On virgin soil, except it is of the poorest nature, it is not necessary to apply any manure for the first crop, as there is usually an ample supply of available plant-food and humus present in such soil, but for subsequent crops, or old land, systematic manuring is very important. Old land that is at all deficient in humus should have that deficiency made good, either by the application of a heavy dressing of farmyard or stable manure, such as a load to every 4 perches, or if this cannot be obtained, then by growing a green crop such as cowpeas or other legume which has been well manured with phosphatic and potassic manures and ploughing it in. The green crop so ploughed in should be allowed to rot and, when rotten, the land should be reploughed and worked down fine. If the green crop has received a generous dressing of phosphatic and potassic manure, then there will be no need to apply any further fertilising material to the land, as a complete manuring has been given; but if not, then the soil should be treated as recommended later on.

The surface of the land should be kept as even and level as possible, and, as already stated, it should be worked down fine, so that when the young plants are set out they will take hold of the soil at once and become firmly established.

Planting strawberries on raw land, sour land, or land that has been indifferently prepared, is only courting failure, whereas, when the planting is carried out as advised, there is every chance of success.

SELECTION OF PLANTS.

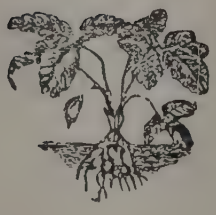
Always obtain strong runners from healthy, prolific plants. The first runners next to the parent plants are to be preferred, as they are usually the most vigorous and best rooted, and, further, they come into bearing earlier; but, failing these, any well-rooted, strong, well-grown runners can be used, and although they will not fruit as soon as the first runners they will give a good yield later on, and frequently continue to bear when the earlier fruiting plants have ceased.

PLANTING.

Having secured suitable plants, trim the straggling roots with a sharp knife and plant as shown in the illustrations herewith, which are self-explanatory. Careless

No. 1.

No. 2.



No. 3.

No. 4.

planting is responsible for many failures, especially too deep planting, as no strawberry will thrive if its crown is buried under the soil.

The distance at which to set out the plants varies somewhat in different districts, but it is not advisable in any case to overcrowd the plants, but to allow plenty of room. Personally, I favour planting strong plants at from 20 in. to 2 ft. apart each way, so that when planted the land can be worked all round the plant; or if row planting is desired, then the rows should be about 30 in. apart and the plants set out at from 15 to 18 in. apart in the row. The illustration of a strawberry garden at Mooloolah shows the manner of planting adopted by one of our most successful growers, and it will be noted that the plants have plenty of room and are in no way overcrowded.

CULTIVATION.

Strawberry plants must only be surface-worked whilst growing or bearing fruit. The object is to keep down weed growth and to prevent the surface of the soil caking; but the cultivation must never be so deep that it will injure the roots. The best implement to use is the Planet Junior hand cultivator or similar machine; or, failing that, a good Dutch hoe of any type that may be preferred.

Weed growth must be kept down and the surface of the soil must not be allowed to become hard and set, as if it does the evaporation of moisture from the soil will be greatly increased, and it will dry out rapidly.

If the plants are to be kept over for a second or third year, then the whole of the runners, other than those required to make good any losses in the original plants, must be removed, and the ground between the original plants must be well broken up and manured in late summer or early autumn, so that the plants will be in good nick for producing a crop of fruit the following season.

If the plants have been badly attacked by leaf blight it is a good plan to cut off all the leaves and burn them prior to working and manuring the land, as numerous fungus spores are destroyed thereby. The burning off is best done by scattering a little loose dry straw over the plants when the leaves have been cut off and have dried, and then setting fire to the lot. A light burning does not injure the plants, but is decidedly beneficial.

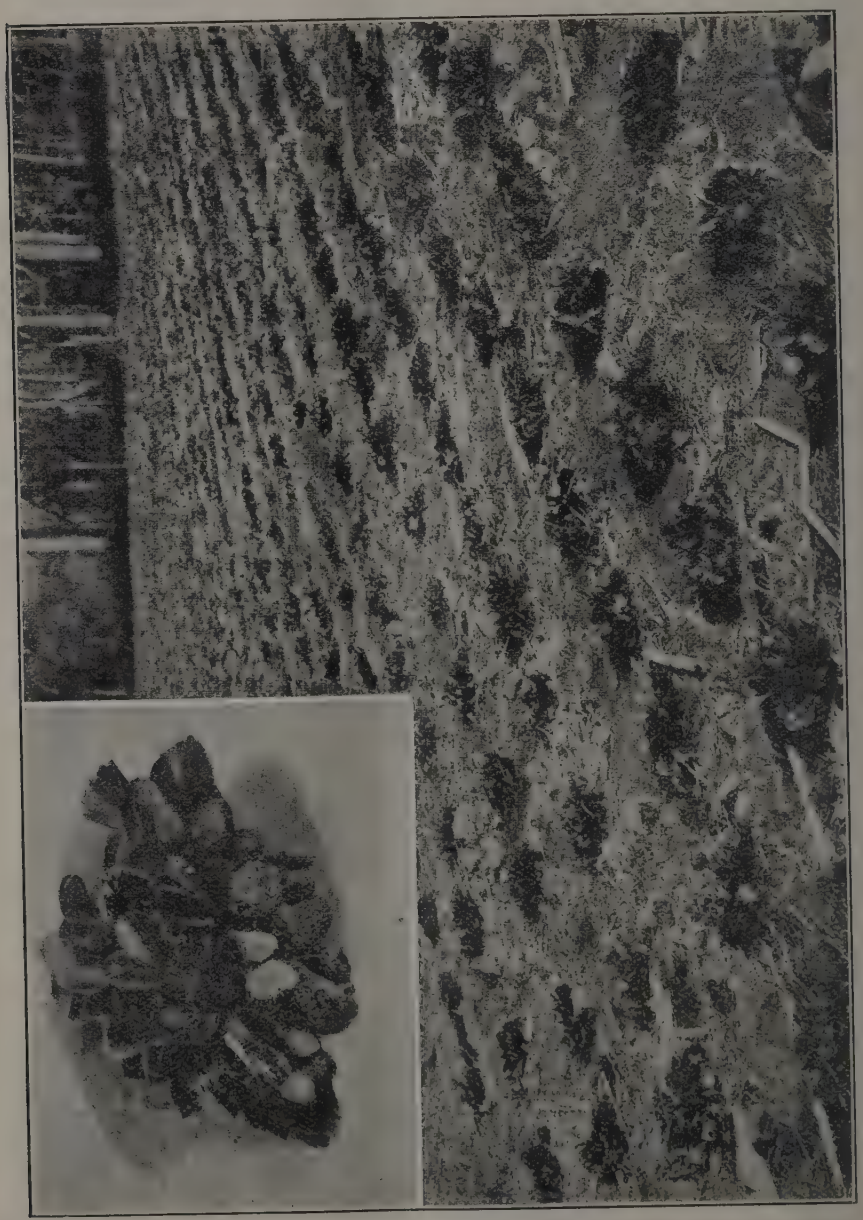


PLATE 32.—A STRAWBERRY GARDEN AT MOOLOOLAH.

MULCHING.

This is seldom practical in this State, and it is of very doubtful value under our local conditions, a light surface soil mulch, such as that produced by working the land with a Dutch hoe or Planet Junior hand cultivator, being all that is necessary.

MANURING.

The strawberry is a fruit that requires an abundance of readily available plant-food, and one that pays well for systematic and judicious manuring. In the 1920 edition of his pamphlet, "Complete Fertilisers for Farm and Orchard," the Agricultural Chemist to this Department gives the following advice, which it will pay to follow:—

"Some of our coastal country, between the 26th and 28th degrees south latitude, is particularly suitable for strawberry culture, frequently producing quite phenomenal crops. Some of our rich loamy soils found in our coastal scrub lands give the best results. In poorer sandy soils the improvement effected by artificial fertilisers, particularly such containing potash, is very marked.

"A complete fertiliser for strawberries should contain 7 to 8 per cent. phosphoric acid (water soluble), 8 to 10 per cent. of potash, and 3 per cent. of nitrogen, and should be used at the rate of 5 to 9 cwt. per acre.

"The following fertiliser mixture may be found useful:—

3 to 5 cwt. basic or ordinary superphosphate
1½ to 2 cwt. sulphate of potash
1 to 1½ cwt. sulphate of ammonia, or nitrolim, or nitrate of soda
} per acre;

or,

1 cwt. fine bonemeal
4 cwt. superphosphate or basic superphosphate
2 cwt. sulphate of potash
1½ to 2 cwt. nitrate of soda
} per acre;

the latter applied by two or three top-dressings, at the rate of 1 cwt. per acre, when fruit is first forming, and thereafter at intervals of two weeks."

GREEN CROP MANURING.

When dealing with the preparation of the soil, the importance of providing an adequate supply of humus was referred to, and the statement made that where a sufficient quantity of farmyard manure was not available to supply this essential ingredient to the soil green crop manuring should be used to make good the deficiency. Humus plays a very important part in the composition of soils, and especially so in those devoted to strawberry culture, as its presence in the soil enables it to retain a much larger percentage of moisture than it would do were it deficient in humus. The power to retain moisture is of the greatest importance in a soil devoted to strawberry culture, as the strawberry is a shallow-rooted plant that soon suffers when there is any lack of moisture.

Moisture in the soil also enables the artificial fertilisers applied to become available, as they are of no use whatever to the crop unless their plant-food is capable of being dissolved by the soil moisture, and can thus be obtained therefrom by the roots of plants. When leguminous crops are grown as a green manure they should be manured with a fertiliser containing lime, citrate-soluble phosphoric acid, and potash; such as a mixture of finely-ground island phosphate and a potash salt, used in the proportion of four of the former to one of the latter. No nitrogen need be applied, as the plants will obtain their own from the atmosphere; and when they are ploughed into the soil it will not only be enriched by the plant foods contained in the fertiliser applied to the soil to produce the green crop, but also by the nitrogen that has been produced by the green crop itself; the whole forming a complete fertiliser, as it contains all the essential plant-foods in an available form. Green crop manuring is the cheapest way in which to apply nitrogen to the soil, so that, taking into consideration its value as a supplier of humus, it is of the greatest value when intensive cultivation is intended; and as the strawberry is a crop that demands intensive cultivation, its importance cannot be over-estimated, especially in soils that are deficient in humus. Cowpeas, vetch beans, small Mauritius beans, and the large black Mauritius beans are the best legumes for summer growth and vetches or tares and the grey or partridge field pea for winter.

MARKETING.

Fruit for immediate consumption should be gathered whilst still quite firm. It should be carefully handled, graded for size and colour, and packed in boxes or trays containing a single layer of fruit. The use of punnets is not so satisfactory, as the fruit is more likely to be bruised, and it is doubtful if the methods of marketing the fruit in single layers can well be improved upon. Fruit for factory use is stemmed, placed in casks or other suitable receptacles, and forwarded as quickly as possible to the factory. Care in handling, picking, grading, or packing, always pays.

DISEASES.

The most serious diseases of the strawberry in this State are those of fungus origin—viz., leaf blight and mildew.

The former can be controlled by the use of Bordeaux or Burgundy mixture applied as a spray, combined with the burning off of affected leaves, as previously mentioned; and the latter can be kept in check by means of sulphur applied in a similar manner to that employed for the treatment of oidium in grapes, or by spraying with sodium or potassium sulphide or a weak solution of lime sulphur. Insect pests seldom do any very serious injury, but when leaf-eating beetles or other leaf-eating insects are present they can easily be destroyed by spraying with arsenate of lead.

VARIETIES.

Although most of the standard varieties of strawberries have been grown in Queensland at one time or another, experience has shown that no one variety has proved permanent, but that it has been necessary to either raise new kinds from seed or to introduce them from elsewhere. Varieties producing perfect flowers have proved more profitable than pistillate sorts and are therefore most commonly met with.

After being grown in this State for a few years most varieties become weaker in growth, more liable to disease, and less prolific, so that they have to be discarded. The introduction of new sorts is thus essential, and there is no better way of doing this than by raising local seedlings. Some of the best sorts ever grown in the State have been locally raised seedlings, of which the *Aurie Anetta* and *Phenomenal* are good examples, and there is no reason why sorts equal or even superior to these should not be produced. Of the well-known standard varieties, such as *Marguerite, Trollop's Victoria, British Queen, Pink's Prolific, Federation, Melba,* and *Edith,* and several others that have been grown from time to time in this State, few are now planted. *Phenomenal* (a Gympie raised seedling) is now the variety most commonly met with; other new varieties are being tested and some of them may prove to be adapted to our local conditions. The type of strawberry best suited to this State is a vigorous healthy grower—that is, a good bearer and producer of good coloured fruit of good, firm texture and fine flavour; a fruit that keeps and carries well, and that meets the requirements of both the fresh fruit trade and of the jam maker.

ORCHARD NOTES.

Mr. Charles Ross, Instructor in Fruit Culture, reports on a recent visit to the South Coast as follows:—

Among the ravines on the east and north-east slopes of Beech Mountain I saw some 400 or 500 acres of real sub-tropical scrub—typical banana country. The area is situated within 7 miles of Nerang Railway Station, and 10 or 12 miles from Southport. The soil consists of strong shaley, clayey and volcanic loams, highly suitable for banana culture. Two small plantations of 2 or 3 acres each, planted sixteen months ago, have made splendid growth, and, in spite of lack of attention to suckering, an overgrowth of weeds, and the production of a good crop of maize, some of the stools are carrying bunches of from 10 dozen to 12 dozen fruits. One hand held nearly 40 fingers of a good marketable size.

I should like to emphasise that it is a mistaken policy for growers to allow more than two stems per stool for carrying the mother (or first) crop, and for future crops three to four followers are ample. By adopting this method of pruning the product, the aggregate will be better and heavier and the period of production will be extended by several years. In several instances I noticed in the aforementioned plots fifteen to twenty-five suckers per stool; this means a much shortened life and an inferior product.

Of a visit to Boonah, The Nest, Aroo, and Coochin Coochin, for the purpose of examining young grape vines and citrus plantations previously recommended, Mr. Ross reports:—

I found that the vines from last year's cuttings had struck well and had made good growth. The percentage of misses was small. All the citrus trees planted last year had done well. Old trees planted in stiffish soil on dry ridges, which did well enough whilst young and vigorous, are now in a bad condition and pest-infested. I gave instructions for the rooting up of worthless subjects, the persistent and systematic applications of sprays, the choice of sites, varieties to plant, and future culture of new plantations in lighter soil and better-drained situations.

Horticulture.

GARDENING FOR AMATEURS: ROSE-GROWING.

By E. W. BICK, Curator Brisbane Botanic Gardens.

To grow roses to perfection it is necessary to have a good heavy soil, healthy well-rooted plants, plenty of light, manure, and water. The first thing to be done is to choose the position of the rose beds. In small gardens, of course, too often there is not much choice in the matter, but those who are more fortunate and have plenty of room should choose a nice open situation and the best soil possible. Do not plant near to large trees, or in too sheltered a position; the trees rob the soil, and the very shady situation produces mildew, other diseases, and often weak, spindly growth. An easterly aspect for the morning sun is the best, but too much stress should not be laid upon this, as long as a nice open position is provided. After selecting the position preparation of the soil follows. The beds should not be large, say, to hold about a dozen plants. If larger are required, make them wide enough to hold about three rows, the plants to be from 3 to 4 ft. apart, the robust growers to be the greater distance.

The best soil for rose growing is a nice heavy loam. Some of the red volcanic soil is very suitable, also the black, the worst being dry, hot, sandy ground; but roses may be grown in almost any soil, for this can be improved by treatment. The Brisbane shale, by plentiful use of manure, will grow excellent roses. If the soil be very heavy—i.e., a large percentage of clay, for instance—it may be improved with a good layer of ashes and a dressing of lime once a year. The lime sweetens the soil also. Light soil requires an addition of heavy stuff—sometimes this can be obtained by trenching. This latter is necessary if the bottom soil is very stiff, sometimes a double-spit digging is sufficient. If this is done, work in plenty of manure—horse and cow manure mixed is best and sheep manure is also very good; all these should be fairly well decayed. In light, sandy soil work in decayed vegetable matter—leaves, &c., and wood ashes; the firstnamed will provide humus, and in conjunction with the ashes will help retain moisture. It is important that these and manure be worked through the soil. Don't leave them in layers.

For planting, June is about the best month; a month earlier will not be harmful, or a week or two later; but those planted in June will get a good hold and make growth before the hot summer weather comes. When planting, open a hole about 2 feet across and a foot deep; this will provide room to spread the roots nicely. If any of these are bruised and broken, cut off with a sharp knife. Hold the plant in the left hand at such a depth that will place the union of bud and stock about an inch below the surface of the ground, spread all roots evenly so that they do not cross each other, then throw a little loose earth on, adding a little at a time, and shaking the plants lightly to settle the soil between the roots. When about 4 inches of soil has been added, tread firmly; then add the remainder of the soil through which a handful of bonedust has been mixed. Leave a "saucer" around the plant to hold water, and thoroughly soak.

Pruning may be hard, moderate, or slight. To prune hard, the thin weakly or diseased wood is first removed, and the main branches are reduced to from three to five in number; these are then cut back to from 6 to 8 inches in length. Be careful to always leave the first bud below the cut pointing outwards in all cases or the new growth will grow towards the centre of the plant, making it too thick. Moderate pruning means, after the thin, weak, and dead growth is cut out, the main branches are reduced to from 4 to 6 in number and left from 12 to 14 inches in length. Light pruning is removing all dead and diseased wood, together with any thin weak growths; the tips of the shoots are shortened back. With some hybrid perpetual roses that make long, strong growths, such as Frau Karl Druschki, a lot of flowers can be obtained by pegging the ends down, putting a good curve on the stems; these will then flower at every eye. There is a marked difference of growth in roses, some being very strong and vigorous, others making very little wood. Prune the latter hard to induce growth, and lightly prune the strong grower. When cutting flowers cut long stems; don't be afraid; it is like a pruning. Cut out decaying wood at any time, it will help the plant. After pruning old plants, manure well and dress with well slacked lime. This is best applied by wetting the stems and throwing the dry lime on; sufficient will stick to kill all insect pests.

Botany.

THE CAROB AND ALGAROBA BEANS.

By C. T. WHITE, F.L.S., Government Botanist

For some time past the Department of Agriculture and Stock and private persons have been importing into Queensland seeds of both the Carob and Algaroba Beans. As the former is also often called the Algaroba, and is in fact the original Algaroba, there has been some confusion in the popular mind between these two trees. This is unfortunate, as they are widely different in appearance, and whereas the one is only suitable for cultivation in the cooler parts of the State the latter is more particularly adapted for the warmer. As both trees, though of considerable economic importance, are little known to many persons in Queensland, the following article and accompanying illustrations are offered. For the sake of convenience the name Carob is here applied to *Ceratonia siliqua* and the name Algaroba is confined to *Prosopis juliflora*, as it is to this latter tree that now-a-days the name Algaroba seems most commonly applied.

CAROB BEAN (*Ceratonia siliqua*).

Description.—A tree 20 to 30 ft. high, leaves pari-pinnate, each leaf composed of 3 to 8 pairs of leaflets; leaflets oval, entire, paler on the under surface, coriaceous in texture, 1½ to 2 in. long, 1 to 1½ in. broad. Flowers polygamous, greenish, small, in short racemes, calyx small, soon falling off, corolla none; stamens five, pistil glabrous, in male flowers abortive, in female and hermaphrodite shortly stipitate, ovary several-ovulate, style 3 to 4 in. long, flattened, indehiscent; seeds dark reddish brown, 3 to 4 lines diameter, enclosed in scarlet sugary pulp.

Note on the Flowers.—Like another well-known plant—the Papaw—the flowers are polygamous—*i.e.*, the flowers may be distinctly male or female and borne on different trees, or hermaphrodite—*i.e.*, male organs (stamens) and female organs (pistil) growing in the same flower. This latter condition, however, is apparently rare, the majority of the trees being distinctly either male or female.

Distribution.—A native of the Mediterranean region (Southern Europe, Western Asia, North Africa). Cultivated in most warm temperate countries.

Botanical Names.—Keratea, the ancient Greek name of the tree, is most likely the origin of the generic name. *Siliqua*, Latin, meaning the pod or husk of leguminous plants.

Common Names.—Carob Bean, St. John's Bread, Locust Tree.

In his "Encylopædia of Plants," J. C. Loudon has the following very interesting statement:—"The pods contain a sweet foecula for the sake of which they are often imported into England under the name of Algaroba Beans. This word is a slight alteration by the prefix of the article *al* of the Arabic word Kharroub, whence also our English name Carob. This is generally considered the Locust Tree of Scripture. The tree is also very common in the south of Spain and often formed the principal food of the British cavalry horses during the war of 1811 and 1812."

Cultivation.—F. Turner, writing in the "Agricultural Gazette of N.S.W.," states:—"The best time of the year to sow Carob seed is in August. The outer covering of the seed is very hard, and before they are sown they should be placed in an earthen vessel and hot water poured on them, then kept near the fire till they soften. The seeds should be planted in boxes or pots and the seedlings, when strong, say about six months old, transplanted into their permanent quarters." It can also be propagated by cuttings, and on this method Mr. Turner has the following remarks to make:—"For putting in cuttings, March or April is the best month. Cuttings of the ripened wood of the current season's growth, about 6 in. long, and either heeled or cut just below a joint; the leaves should be shortened. They will strike more readily if put singly into boxes filled with sandy soil and kept in a shady situation until rooted, when they should be gradually inured to sunlight. The cutting should be rooted and ready for transplanting in about six months' time. Layers, of course, are only possible when branches are near the ground." The great advantage of propagating by cuttings, layers, or grafting is that female or pod-bearing trees can be obtained when necessary, whereas with seed one has to take the chance as to the relative numbers obtained of male and female plants, and no distinction even to the trained eye can be seen between the plants in a young stage—*i.e.*, before flowering.

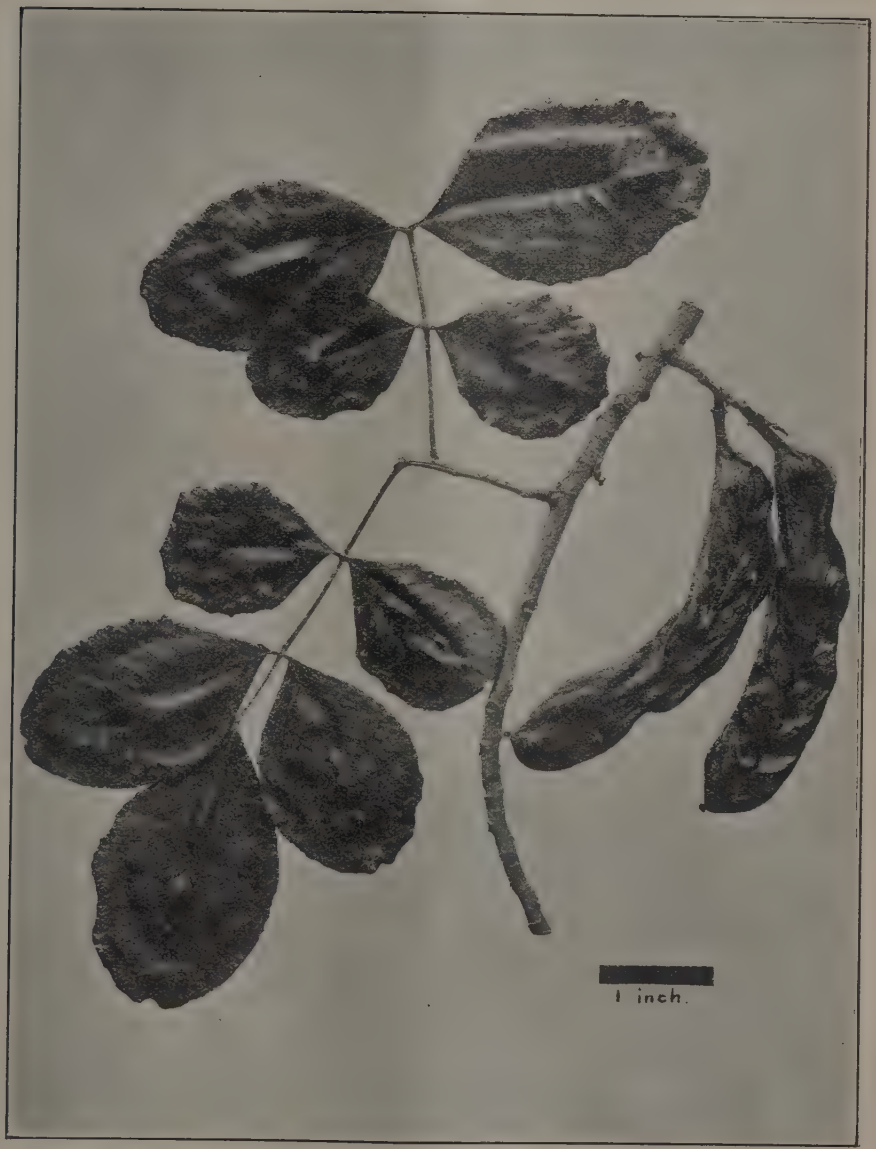


PLATE 33.—CAROB BEAN (*Ceratonia siliqua*).

The tree can be grown in the Brisbane district, but it is doubtful if it would succeed much further north, being more adapted for the cooler parts. It does well on the Darling Downs and similar localities, provided the frosts are not too severe.

As already explained, the trees are unisexual, *i.e.*, distinctly male and female; hence for pods to be formed there should be a proportion of male trees among the female to ensure fertilisation, otherwise the pods will fall off before maturity. In his article Mr. Turner goes on to state:—"If it should happen that all the trees in a group should produce female flowers only, branches bearing male flowers can safely be brought from a distance and hung among the branches bearing female ones so as to effect fertilisation. I have known this to be done with trees growing 14 miles apart and be successful. Persons who grow Carobs should keep a few bees, if it is only one hive; it is astonishing the number of flowers these insects will visit during the course of a day and be the agency whereby many of them are fertilised."

ALGAROBA OR MESQUITE BEAN (*Prosopis juliflora*).

Description.—A tree attaining 60 to 70 ft., branches usually armed with straight spines, either solitary or in pairs. Leaves bi-pinnate, usually occurring in little tufts or fascicles, pinnæ 1, 2, or rarely 3 pairs; leaflets usually 10 to 12 pairs, oblong, 3 to 4 lines long. Flowers small and numerous, borne in long slender spikes of 3 to 5 in. Pod yellow, shortly stalked, 5 to 8 in. long, marked between the seeds with transverse lines, fleshy with a sweet, sugary, more or less spongy pulp; seeds light-brown, enclosed in a hard, parchment-like casing (endocarp).

Distribution.—A native of South America, West Indies, Central America, Mexico, and the Southern United States.

It is now widely cultivated in tropical countries as a fodder and ornamental tree. Speaking of its introduction into the Hawaiian Islands, J. F. Rock in the "Leguminous Plants of Hawaii," states:—"The Algaroba is the most common as well as the most valuable tree introduced into the Hawaiian Islands. All the waste lands which previous to the introduction of this valuable tree were absolutely barren are now covered with green forests made up exclusively of this tree. The tree was introduced by Father Bachelot in 1828, the seed having come from the Royal Gardens at Paris, France."

Botanical Name.—Prosopis, origin obscure; "Prosopis" was a name given by Dioscorides to the Burdock (*Arctium lappa*), a plant very dissimilar to any species of Prosopis. It bears spiny burrs, however, and this may have led Linnæus to bestow the name Prosopis on these trees on account of their spiny nature; *juliflora,* flowers in July.

Cultivation.—Seeds should be sown in the spring or early summer. The pod contains up to about 20 seeds. Each seed is surrounded by a hard parchment-like casing. This should be removed with a sharp knife before the seeds are sown. C. S. Judd, writing in a recent number of the "Hawaiian Forester and Agriculturist," found that pouring hot water over the seeds and letting them soak for twenty-four hours greatly accelerated their germination, but they may be sown without any treatment at all, germination then, however, being considerably slower. They should be sown in pots or boxes and when strong enough the young trees can be planted out into their permanent quarters.

As in this tree the flowers are hermaphrodite, there is no need to worry over their fertilisation as in the Carob.

This tree succeeds well in the Brisbane district and fruits well. It is doubtful if it would succeed much further south, but is more particularly adapted for growing in the warmer parts of the State.

THE GOOSEFOOT (CHENOPODIUM TRIANGULARE).

Writing from Llanely, Hunterton, Mr. E. A. Thomas says:—"I was much interested in your notes in the April Journal on the 'Weeds of Queensland.' I find the Goosefoot as described is fairly common in this district, chiefly in the brigalow scrubs and on ground used by cattle for camping places. I notice also that in summer and autumn the stock do not eat much of it, but it is a great stand-by about July and August, when the usual grass fare is very much off. With the shelter from cold afforded stock by the brigalow scrub, cattle keep in excellent condition."

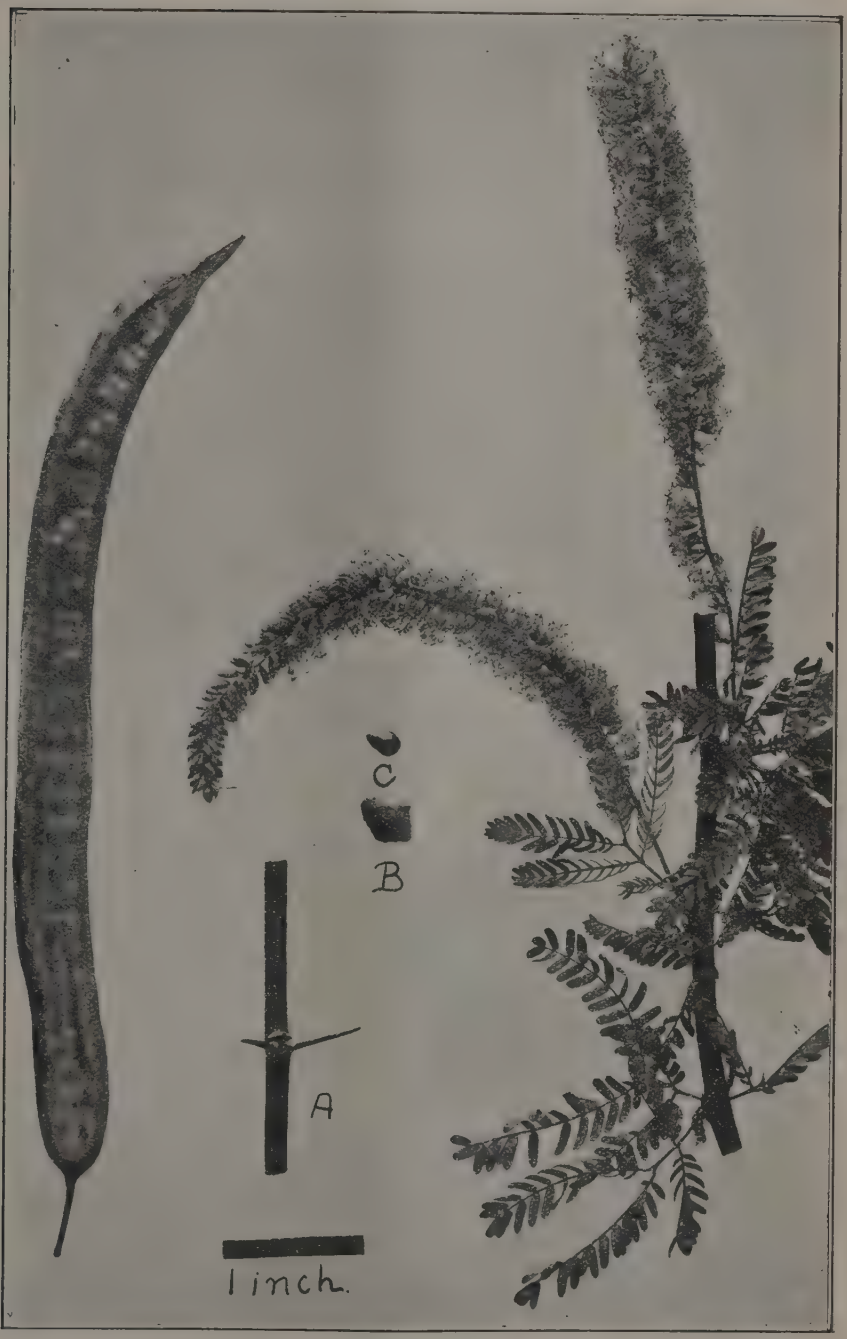


PLATE 34.—ALGAROBA OR MESQUITE BEAN (*Prosopis juliflora*).
A.—Portion of a branchlet showing the large paired spines.
B.—Seed enclosed; and C.—Seed freed from the parchment-like husk.

Forestry.

QUEENSLAND TREES.

By C. T WHITE, F.L.S., Government Botanist, and W. D. FRANCIS, Assistant Botanist.

No. 3.

LIGNUM-VITÆ (*Vitex lignum-vitæ*).

Common Names.—Lignum-vitæ, Satinwood.

Derivation.—Vitex, an ancient name for some plant of the osier (willow) tribe (Loudon); lignum-vitæ, the colonists' name for the tree.

Description.—A tree attaining a height of 130 ft. and a barrel diameter of 3 ft. In many cases the barrel is not symmetrical, but angular, in cross section, and mostly is not prominently flanged at the base. Bark light grey, grey, or sometimes brown, often slightly fissured or wrinkled; when cut, bright yellow, measuring $\frac{3}{16}$ in. thick on a tree with a barrel diameter of 1 ft. 9 in. Young shoots, young branchlets, and inflorescence downy, with rust-coloured hairs. Younger branchlets often 4-angled. Leaf stalks $\frac{1}{4}$ to 1 in. long. Leaves opposite, elliptical or lance-shaped in outline, mostly pointed at the apex, upper surface glossy, underside dull, midrib, lateral nerves and net veins visible on both surfaces, but more prominent on the underside; measurement of leaf blade, 2 to 4 in. long, twice to three times as long as broad. Flowers few, in small forked bunches (cymes) situated in the forks of the leaves, the cymes generally shorter than the leaves. Individual flowers on stalks about $\frac{1}{4}$ in. long, each flower measuring about $\frac{1}{2}$ in. long; the lowermost part, the calyx, is cup-shaped, hairy, about $\frac{1}{16}$ in. long, and has an entire rim. On the inside of the calyx is the light purple hairy corolla which is tubular in the lower part and 4-lobed in the upper part; it is curved, and the three lower lobes are spreading or horizontal, while the upper lobe is erect; it measures about four times the length of the calyx. Inserted in the tubular part of the corolla are four stamens, in pairs; they protrude beyond the lobes of the corolla. The ovary, situated in the centre of the flower, is round and hairless, and is surmounted by a slender style about $\frac{1}{8}$ in. long. The fruit is a red globular berry, about $\frac{1}{2}$ in. in diameter, enclosing a round "stone" about $\frac{1}{4}$ in. in diameter. The "stone" contains four cells; each cell contains a mature or abortive seed.

Flowering period, irregular. Both flowers and fruit are often available at various times of the year.

Distribution.—Confined to Eastern Australia. North Coast district of New South Wales. In Queensland it extends westward to the Bunya Mountains (about 100 miles inland); our northernmost record is Baffle Creek in the extreme south of the Port Curtis district.

Uses.—As the timber is more durable than most of the scrub timbers, it is occasionally used for fencing posts. It should be useful for cabinetmaking and indoor fittings. We know of no reason why it could not be used for purposes such as flooring, as it is much more durable than pine.

References.—Vitex lignum-vitæ. A Cunningham, ex Schauer, in A. de Candolle's "Prodromus," vol. XI., p. 692; Bentham, "Flora Australiensis," vol. V., p. 67; Bailey, "Queensland Flora," Part IV., p. 1179.

Photo. by the author.]

PLATE 35.—LIGNUM-VITÆ (*Vitex lignum-vitæ*), Kin Kin.

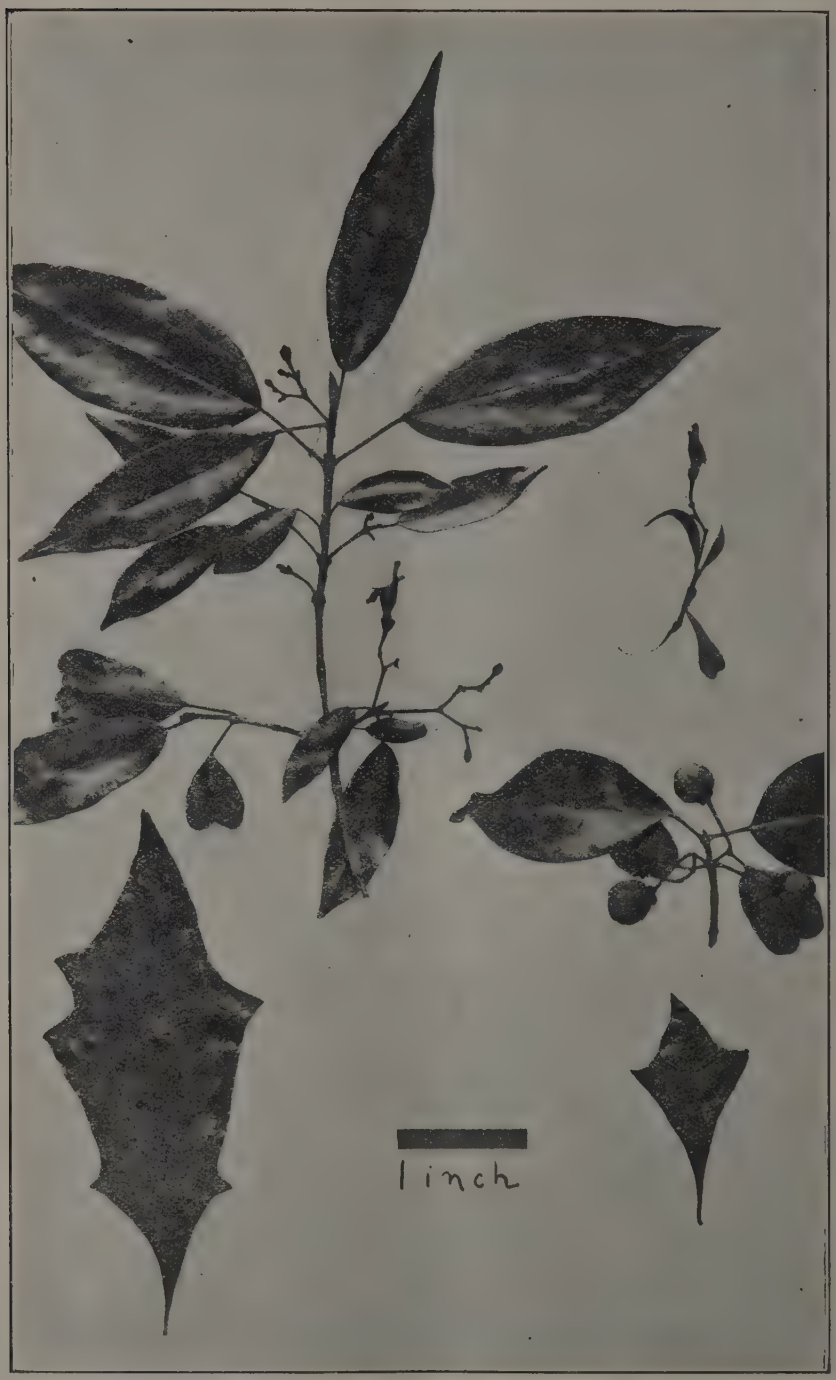


Photo. Dept. Agriculture and Stock.]

PLATE 36.—LIGNUM-VITÆ (*Vitex lignum-vitæ*).

The two lobed leaves at the bottom represent leaves from a stump growth.

THE TIMBER FARM AND ITS PRODUCTS.

By E. H. F. SWAIN, Director of Forests, Queensland.

I have met quite a number of agricultural farmers who have indicated to me their belief in the dispensability of the forester and his forest.

Among others, was an amateur agriculturalist, who was also a business man and who on encountering some difficulty in securing a coveted corner of a State Forest upon which to grow "one blade of grass where two trees grew before," vouchsafed the opinion:—"The sooner the forest reserves are cut out and thrown open, the better for the country." Asked what he would do for timber when that consummation was attained, he guaranteed the materialisation of an abundance of cheap substitutes from somewhere in general and nowhere in particular.

That morning my friend had risen from a wooden bedstead in a wooden house, pulled up the wooden venetian blinds, and at his wife's request, transferred the baby from the wooden cradle to the wooden perambulator, and promenaded it along the wooden veranda on the side protected from the hot morning summer sun by umbrageous trees. His wife in the kitchen had lit the wooden fire, and from the taps there, and in the bathroom, had flowed the water conserved by the mountain forests and brought to his home through metal pipes mined with the aid and protection of wooden-handled tools and mine props. The wooden safe and the porridge ladle had contributed towards his well-being whilst he brushed his hair with a wooden-backed hair brush and used a comb made of a mixture of woodpulp and camphor from the camphor laurel forests of Japan. A pair of leather slippers made of brown paper that once was part of a tree encased his feet and protected them against the cold linoleum that once grew in Spain as the bark of the Cork Oak forests. At breakfast he sat down on a wooden chair at a wooden table, and consumed meat and cereals and drink grown under the lee of neighbouring protective forests and brought therefrom in wooden cases and wooden carts. In front of him was the morning paper, the issue of which had swallowed up several scores of acres of pine forest in the United States of America. Having refreshed himself, he picked up a wooden toothpick, struck a wooden match, lit his wooden pipe, grabbed his wood-pulper "leather" case, and took his wooden walking stick from the wooden hall-stand. Leaving his forest-grown goloshes behind, his feet found sufficient protection against the wood-tarred pavement and the wood-blocked streets, because the soles of his boots were made of the new patent Ironite composition manufactured from wood pulp, and the uppers were tanned by Australian wattle bark imported from South Africa. He caught a wooden train which travelled on rails supported by thousands of tons of hardwood sleepers, and was propelled by coal exhumed from buried forests. A motor-car with wheels shod by the sap of a tropical tree and a body built of Queensland timber, met the train and conveyed him to his office, where once more he sat down to a wooden table on a wooden chair, picked up a pen with a wooden handle, dipped it into ink made from the gall of the oak trees, and penned a telegram on paper grown in a forest thousands of miles away and brought thither in wooden ships. The telegram hopped from ironbark pole to ironbark pole for another thousand miles, and, in due course, as a result, his wooden warehouse was filled with huge wooden crates containing pianos, violins, organs, orchestrelles, and other musical instruments, including gramophones encased in maple cabinets and records made from wood pulp.

For by the sale of these wooden things my friend lived.

The end of a perfectly wooden day was that he dropped into another wooden place on his way home, levied on a wooden cask for a fluid made from hops grown on wooden stakes, and buried a contented face in a head of foaming froth brewed from the bark of Quillaia Saponaria, a tree from a South American forest. Much refreshed, he made his way home, a wooden toy under one arm for his son and heir, and under the other a bottle each of forest-grown quinine and eucalyptus oil for his wife's cold. *En route*, he devoured with vast satisfaction the detailed statistics and full account of the greatest national event of the year—Macartney's stylish display in England with some bits of wood. That night, after two hours' blissful nursing of a wooden billiard cue, my friend returned once more to his wooden bedstead more than ever convinced in his wooden head that forests were an entirely unnecessary commodity, and that foresters might be grouped generally with price-fixing commissioners as unmitigated public nuisances.

And my friend slept well that night because the baby was bluffed by a forest-grown rubber dummy protected by an ivoroid disc made out of distilled wood.

Some of my friends may repudiate the wooden comforts of the city and deny an indebtedness to the forest equally as great as that of the piano seller. Acknowledgement will be made, however, to wood as timber for farm houses and barns, fences, and pig troughs, cow-bails, and fruit cases. It will be admitted, also, that as

a stand-by in drought, bottle-tree pith and kurrajong and wilga foliage are of some small service, and that there is a little wood in ploughs and harvesters and a modicum of caoutchouc in a milking machine. But for the bole and bark of a tree, stock whips and saddles would have neither form nor substance, and to wood is owed immunity of potatoes from Irish blight and of wheat crops from rust and smut.

Wood may be served not only raw, but also cooked, and many a delectable dish, many a work of art, and many a cunning manufacture has been and is being materialised from a forest which the community at large too often has sought to destroy as an encumbrance to progress and a barrier to civilisation.

Wood may be roasted. The roasting of wood is being carried on as a large and profitable undertaking, for instance, not 50 miles from Melbourne, where waste hardwood to-day is being converted in a long series of wood distillation products. Giant pots are filled and placed in giant ovens and baked for a day and a night. The opening of the pie discloses a thick crust of charcoal which is cooled and bagged and despatched to the city. Some of it goes to the suction gas engine which serves, among others, the soda-water maker. More of it goes to the ironworks for use in the reduction of iron to best Swedish steel. The juice of the pie is skimmed for its tar and its creo oils, which are served up to the wood-blocker and the house painter. There remains pyroligneous acid, the acid of smoke, used for expediting the curing of bacon and hams. Lime is stirred into the pyroligneous acid and acetate of lime is withdrawn and handed to the chemist. To some of it he adds sulphuric acid and puts it on the fire to warm. The brew, refined, is acetic acid, which, undiluted, becomes a cure for corns, or a solvent of oils, resins, and camphor, and diluted, serves as vinegar in the manufacture of the pickles and sauces which figure so prominently on the farmers' wooden table. The calico printer and dyer buys this acetic acid to make his sugar of lead, and compounds it with copper to produce a green pigment. When the acetate of lime is warmed up without any sulphuric acid, the result is acetone, instead of acetic acid, and this is employed either to dissolve gun cotton to make cordite to damage people, or to produce chloroform to assist in their repair. Alternatively, it may be employed to make a high-grade varnish, a celluloid collar and stud for Sunday, and a doll and a playball for Christmas morning.

There still remains in the pie a liquid residue, which, on being distilled, produces on the one hand common methylated spirits, and on the other methyl alcohol, used in the manufacture of the many brilliant coal-tar dyes. But methyl alcohol may be treated and the vapour passed through platinum gauze, when, uniting with the oxygen of the air, there is precipitated formalin, which the farmer's wife knows as a disinfectant and which the farmer himself uses to clean his seed potatoes from Irish blight and his seed wheat from rust. From formalin may be produced also artificial ivory for the piano and the baby's dummy, and imitation tortoise shell for the wife's hair comb.

According to Dr. A. G. McIntyre, of Ottawa, the earliest British works for the distillation of wood and recovery of pyroligneous acid were erected between 1790-1800, and these existed in connection with the supply of charcoal for the metal industries of the districts of Sheffield and Glasgow and the production of acetic acid and acetates for the dyeing and calico printing industries. In the United States of America to-day there are over a hundred such factories with a total capacity of consuming more than a million cords of wood per annum. In Canada there are thirteen factories producing approximately 13,000 tons of grey acetate of lime, 60,000 tons of charcoal, and 1,000,000 gallons of methyl alcohol.

Wood may be boiled as well as roasted. Chipped and put in a boiler with more than a pinch of soda, it is stewed to shreds and emerges on a metal plate as a sheet of wood pulp, the raw material for a long line of great subsidiary industries. As the daily newspaper it becomes the most important influence of modern times. Made up into books it spreads knowledge over the entire face of the earth. As writing paper it is the vital circulating medium of all trade and industry; and as brown paper it is the last hope of retail business.

We are told that the morning issue of a New York newspaper swallows up 90 acres of American pine forest. Great Britain consumes 5,000,000 tons of paper a year, to produce which about 10,000,000 tons of timber are needed. In 1918 Canada exported paper and wood pulp of the value of 132,028,000 dollars. The following year, the value had increased to 256,689,000 dollars.

But science now has ousted even the silkworm and from wood pulp is spinning commercial silk in commercial quantity, and at commercial price. Technically, the product is known as lustracellulose, which, being prepared from structureless solutions of cellulose derivatives may be said to be structureless, and therefore approximating to true silk which is produced in solution in the glands of the silkworm and extruded into the atmosphere, the worm performing the mechanical operation of drawing and

laying the threads in the specialised form of cocoon. In 1914 the American production of artificial silk was 300,000 lb. avoirdupois; in 1918 the new industry was producing no less than 13,000,000 lb.

Thus is the sericultural farmer being disposed of by a new and unexpected competition. Nor is the cotton farmer entirely free from danger, although cotton produces a better balanced and more stable form of cellulose than wood. The cotton blockade of Germany did not end the war, but resulted in abnormal development in Germany of the wood cellulose industry, which supplied both an abundance of gun cotton and of acetone, the compounding of which produces cordite. Not only were explosives thus obtained from Germany's 25,000,000 acres of State Forests, but also the very uniforms of the soldiers and the sand bags of the parapets. Since the armistice the new industry has expanded, and a recent cable announced the exportation from Germany to India of large quantities of suitings made from artificial silks and cottons, via the wood-pulping process. These new wood-pulp textiles have proved to be formidable competitors of wool, and one factor of the present wool crisis in Australia is the abstention of Germany from purchase of wool, and its substitution of clothes made directly from trees.

The wood invasion is only just beginning. Not only may silk stockings and neckties be supplied by the forester, but also felt hats, rope, twine, rug yarn, carpets, potato and onion bags, bootlaces, and braiding, and belting, and matting, paper webbing and bagging, absorbent, suit cases, trunks, leather soling, tennis shoe uppers, lace curtains, and table cloths, and even linoleum. More than 20,000 tons of wood flour, valued at 300,000 dollars, are used annually in the United States of America in the manufacture of dynamite and inlaid linoleum. A new American paper-bottle machine turns out 5,000 sanitary milk containers an hour, each bottle being finished from raw pulp in about eight minutes. One ton makes 60,000 bottles. The bottle is finished and made impervious to liquids in a bath of paraffin. The cork in the bottle, the gum on the envelope, and the postage stamp, the varnish on the motor-car, the coir fibre and the wood wool of upholstery, the art gum and eraser of the office and studio, all are derivatives of the forest. No fewer than twenty-five factories in the United States of America are using spun paper in the manufacture of fibre rugs, and one of these factories is said to be turning out 25 tons of rugs a day. Not only the logwood, Brazilwood, and fustic of South America, but also the ground leaves of our own brown stringybark furnish a commercial dye. Low-grade eucalyptus oils enable the Broken Hill Mining Company to work low-grade ores. Although no longer made of British oak, Britain's bulwarks exist by virtue of trees. My lady's toilet is indebted to the forester for some of its rarest perfumes. Bloodwood kino contains 72 per cent. tannic acid. The Queensland foambark provides a new commercial saponin. The oleo resin of Queensland kauri is almost identical with turpentine. The latex of the Queensland milkwood is convertible into plastic gum, and low-grade rubber. The silky oak and hoop pine of Queensland offer the best Australian pulp woods yet examined by the Westralian Forest Products Laboratory. The oil of the citron-scented gum may be used either to dispel mosquitoes or to scent soap. The oil of the lemon-scented ti-tree in the chemist's hands becomes lemon essence and lemonade. The "wool" of Frazer Island Macrozamia is a vegetable kapok. The tulipwood and the water gum make a good tobacco pipe.

Once upon a time the forest provided the entire sustenance of peoples. It can still furnish a healthful diet of game and bacon, fish and fowl, eked out by truffles and mushrooms, sago flavoured with either cocoanut or cinnamon, breadfruit, honey, and maple syrup, and sugar, together with an abundance of nuts, among which our own Queensland Bopple and Bunya nuts rank high. It also makes a useful contribution of cork and wood to the present day refrigeration of foodstuffs. It is able finally to produce the culminating liqueur. A French factory by hydrolysing the cellulose of sawdust under pressure with sulphurous or sulphuric acid is now manufacturing a large quantity of high-grade alcohol for fortifying cognac in place of beet sugar alcohol. Forests have been butchered, the climate altered, bird life interfered with, and insect pests encouraged, all through lack of knowledge and foresight.

Forest products have, in addition, other values. Loss of appetite may be remedied by Peruvian bark or our own Queensland alstonine. The sapling Cascara sagrada from the United States of America or the Rubra Gummi of the British Pharmacopœia (Red-gum gum in Australian), and eucalyptus vapour and camphorated oil will serve to relieve the colds and influenza that follow like Nemesis in the tracks of over-indulgence.

If all else fails, the last resort is again to wood!

Now that forests have become luxuries, we may begin to realise that they always have been necessities.

The present forest reservation of Queensland is proportionate to the postage stamp on the big official envelope.

Tropical Industries.

SUGAR.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report, under date 19th May, 1921, from the Southern Field Assistant, Mr. J. C. Murray:—

MACKAY.—During the month of April, the Mackay cane-growing areas were visited.

The crops here are not as heavy as the abundant rainfall since the New Year might have led many people to expect, the principal reason for this being that the bursts of sunshine between wet periods have not been sustained, and the ground consequently got cold. The soil temperature is at present low, and farmers will have to hurry with their planting before the ground gets colder.

The majority of the varieties the farmers have growing are doing well, especially such canes as Q. 813, 907, 285, 426, Badila, and M. 1900 Seedling.

Cane pests are not numerous this year, although grubs on some of the areas are destroying a certain amount of cane, especially that planted near the scrub.

Borers are attacking the cane in places, but their depredations are largely checked by small ants, which are at present swarming in the cane fields. Several bored canes, on being broken, were found to contain these ants in the borer cavity.

The presence of leaf disease or gumming was not noticed in any of the varieties, although root fungus was affecting the 1900 Seedling on some farms. This may, however, be due to the very wet season and lack of warmth.

It is gratifying to note that most of the recently distributed canes are doing well, especially the Queensland seedlings, and appear to be highly resistant to parasite attack.

After this abnormally wet year, farmers would be well advised, before they plant again, to lime and green manure their soils. Borer soils are more impoverished than those which are carrying vegetation during these wet periods.

The necessity for planting canes with a good root system is borne out by the number of weakly rooted varieties that have fallen in recent winds. This is another matter that requires attention and close observance on the part of the growers.

Regarding cultivation in the Mackay district, the growers are up-to-date. Improved farming implements are in evidence, and the soil tilth is mostly good. Noxious weeds are well in hand, none being particularly troublesome this year.

BUNDABERG.—Reports received by the Bureau of Sugar Experiment Stations, Brisbane, from Bundaberg state that weather conditions are becoming more settled, and from a growing standpoint very favourable, the cane continuing to grow rapidly. It is estimated that fully one-third more cane will be harvested than was anticipated in February owing to better climatic conditions.

THE HERBERT.—The Herbert District reports that very wet weather has been experienced, preventing farming and ploughing operations generally. This will mean a good deal of late planting. The crops here, too, will not be so heavy as expected three months ago.

The excessive rains at Innisfail have also checked the cane to some extent.

Science.

DEHYDRATION.

One of the main activities of the A.I.F. Education Service, which was organised with the object of profitably employing the pre-repatriation waiting time of Australian troops, was a close study, under expert direction, of processes and problems affecting rural industries. Agricultural and stock students were enrolled and given every facility for observing at first hand British and Continental methods of farming, selection, breeding and feeding of stock, preparation of primary products for market, and subsequent commercial operations. In furtherance of the scheme, a hundred selected students, all with previous Australian rural experience, were sent to the United States to undergo courses varying in term from six to twelve months in general agriculture, pig-raising, irrigation, marketing, distribution, and allied subjects. The students placed themselves under obligation to return to Australia at the expiry of their several courses, and to assist in disseminating the knowledge gained and applying the results of their experience. All have now returned, and their influence is being felt already in rural circles.

Among matters that received close attention from the students abroad was the process of dehydration of fruit and vegetables, and one of them, Lieutenant R. G. Booth, who obtained a diploma as a dehydration process expert at the California University, recently delivered an informative lecture on the subject before the Brisbane Chamber of Commerce.

Points made by the lecturer were:—

Older methods of drying food products have not proved entirely satisfactory and, compared with the process of dehydration, are more costly. By their employment it is very hard to keep the product clean and the effect of sun-drying has not always given the best results. One particular method causes "case-hardness" in the product before the whole of the moisture is extracted.

Dehydration is simply the removal of replaceable moisture in such a way as not to destroy tissue, texture, and food value. By the addition of water to the dried product it returns to its original condition. It is a sanitary product right through. There is no loss of the essential qualities of the product.

Heated air circulated in such a way as to allow the escape of one-seventh of the air (air charged with moisture extracted from the product) is the base of the process. The operation is continued until the whole of the water content of the product has evaporated. The process includes pipping, peeling, and slicing.

Dehydrated product may be stored indefinitely.

By soaking in water the product is reconditioned, *i.e.*, restored to its original state with flavour and texture unimpaired.

The saving in packing, storage space, and transport charges on the dewatered product is obvious and of immense commercial importance from the growers' viewpoint. In comparison with the cost of other processes of preserving food products, the advantage is greatly in favour of dehydration.

The market for "green" fruit is necessarily limited, while the market for the dewatered product is more stable and is capable of vast extension.

A dehydrating plant of one-ton capacity and capable of treating two tons per day may be installed at an approximate cost of £347. The cost of operation is relatively very small. Larger plants would range in cost of installation up to £1,500. Plans and specifications in every instance would cost additionally £250.

The Germans during the blockade proved beyond doubt the effectiveness and economy of dehydration under improved processes. In that country 488 plants were in operation, and in 1917, the last year for which figures are available, 1,900 plants were operating and 2,000 breweries were using their equipment for removing water from food products.

In the United States dehydration is strongly favoured, and has been largely adopted. A department of dehydration has been organised, the whole country divided into districts, and a chemist appointed to assist in each. One plant alone handles annually 24,000 "green" tons product which, when dehydrated, finds a ready market.

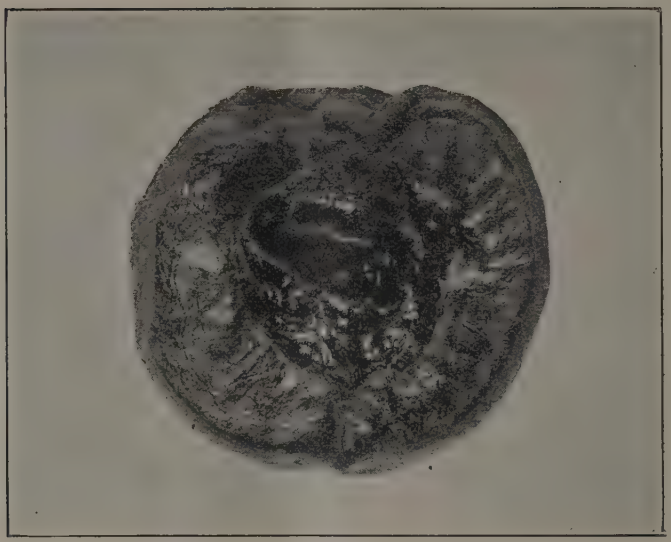


Fig. 1

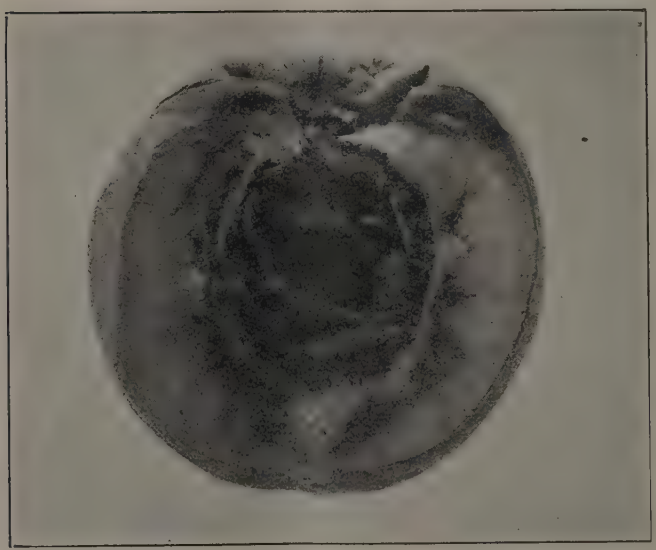


Fig. 2.

PLATE 37.—DEHYDRATED PEACH BEFORE AND AFTER RECONDITIONING.

Dehydrated products may be exported and sold profitably at a low rate compared with the products of other preservation processes.

The lecturer stated that, after five months' work on one of the largest plants in California, he had discovered a process of treating a banana in such a way as to preserve its colour and return, after soaking, to approximately its original condition. The average drying time for one ton of "green" product is eight hours.

The commercial success of the process has been practically proved and its adoption will greatly simplify the marketing problem. By doubling costs and halving prices at present current in America, the Australian grower could obtain a profit of £9 10s. per "green" ton.

The lecturer strongly emphasised the value of attractive packing, of marketing only first quality product, and wide and intelligent advertisement. Legislation may be necessary to prevent the packing and sale of products below standard. The standard set by the American Service authorities is a high one, and both army and navy are supplied with dehydrated fruits and vegetables for issue with the regular ration.

Australia can profit by American experience in standardisation of products. To offer goods inferior in quality and packing is simply courting failure. The present time offers big market advantage for a product new, wholesome, and cheap. Stabilisation and standardisation would follow the adoption of dehydration by fruit and vegetable producers to their great advantage.

Discussion.—In the course of the subsequent discussion, Mr. Stirling Taylor (Director of the Bureau of Commerce and Industry) said that he had tested samples of dehydrated fruits when cooked, and could not detect any difference between it and fresh fruit. He predicted a great future for the banana industry when dehydration is adopted.

Mr. E. S. Little (Commonwealth Trade Commissioner for China) said that the fruit treated by Mr. Booth was the best dried fruit he had ever tasted. He pointed out the possibilities of opening up markets for Queensland dehydrated products in Eastern Asia, where dried fruits and vegetables were largely demanded.

The Hon. A. J. Thynne, M.L.C., remarked that dehydrated fruits had been used in his own household, and he found that the product had seemingly lost none of its original qualities. He foresaw a big future for Queensland dehydrated products.

Experiment.—A segment of dehydrated peach, obtained from among the lecturer's exhibits, has been subjected to experiment in this office by our artist, Mr. Mobsby, who then photographed the specimen (*see* plate). The subject had the usual appearance of dried fruit and after eleven hours in water regained almost remained somewhat shrunken. It may be stated that to retain the flavour when its original size, its flesh becoming a rich, golden, natural colour, though the skin using dehydrated fruits for cooking, the fruit should be first washed and then put to soak in sufficient water to cook it. The fruit should be cooked in the same water in which it is soaked. Our illustrations show (1) the peach in its treated form, and (2) how it appeared after the prolonged immersion.

SHOW DATES FOR JULY.

Biggenden District A.P.S.: 30th June, 1st July.
Mundubbera A.P.I.S.: 5th and 6th July.
Kilcoy P.A.I.S.: 7th and 8th July.
Wellington Point A.H.I.A.: 9th July.
Gayndah P.I.A.H.: 12th and 13th July.
Laidley, Lockyer, A.I.S.: 13th and 14th July.
The Towers P.A.M.A.:13th and 14th July.
Caboolture P.A.I.: 14th and 15th July.
Kandanga, Mary Valley, A.H.I.S.: 17th and 18th July.
Nambour, Maroochy, P.A.H.I.S.: 20th and 21st July.
Townsville P.A.I.A.: 20th and 21st July.
Mount Gravatt and District A.H.I.S.: 23rd July.
Esk P.A.I.A.: 26th and 27th July.
North Pine, The Pine Rivers A.H.I.A.: 29th and 30th July.

Entomology.

THE CANE GRUB.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report, under date 5th May, 1921, upon Cane Grub Investigations from the Entomologist, Dr. J. F. Illingworth:—

For the past month (April) the Cairns district has been deluged with rain; the streams, rising far over their banks, have flooded portions of the river flats for many days at a time, while some fields have been washed away altogether, the land being left a barren waste of sand and stones. Furthermore, during this downpour we had considerable wind, and much of the heavy cane, even on the uplands, was laid flat on the ground, particularly in fields damaged by grubs. These pests, too, have continued their devastation with unabated zeal, working close to the surface of the saturated soil; hence many of our hoped-for results with arsenic, where it was placed in the bottom of the drill with the plants, has been negated. Fortunately, however, these weather conditions which have been so unfavourable for the growth of cane, have stimulated the development of the diseases of the grubs wherever the spores occurred in the soil. And again, the grub resistance of D1135 has been most marked.

GRUB DEVASTATION AND ARSENIC.

At the earliest possible opportunity when our floods abated (13th April) I went over to Greenhills Estate, where the most distressing situation was revealed; hundreds of acres of cane had turned brown, the leaves being almost dry, and some entire fields where the crop was particularly heavy had been flattened by the wind. The grubs had done serious damage practically all over the plantation. The plant cane, most of which was treated by applying arsenic in the bottom of the drill along with the plants, also suffered severely. Investigation showed that the grubs had been forced out of the layer where they would have normally been in contact with the poison, because the soil was super-saturated, and that they were eating right into the stalks at the surface.

In our experimental field of D.1135, in which the arsenic was applied in May, 1920, after the drills had been pretty well filled in by rains and cultivation, we found results more encouraging. Though the winds had bent all the cane down, as is usually the case with this variety, that in the plots which had been treated with sufficient arsenic was still firmly rooted and growing strong. Furthermore, as an illustration of the resistance of this variety, I found that even the cane in the checks, where the roots had been entirely eaten away by the grubs, had rooted from the nodes, wherever they touched the soil. This cane was growing strong again, with no indication of a shooting of the lateral eyes, as is commonly the case with Badila under similar circumstances.

The treated plots referred to in the March report, especially the one that had arsenic at the rate of 200 lb. per acre, showed splendid colour. Digging out a stool we found no grubs, and the roots were most vigorous, about 12 in. in length. This favourable result is apparently due to the poison being nearer the surface, where the grubs continued to get it, even when forced upward by the excessive wet.

I was hopeful that this year we would be able to get conclusive results, but there is evidently much more to be learnt in regard to this feature of the problem of grub-control, particularly as to the amount to use and the method of application; yet, though I am compelled to leave just when success seems imminent, I trust that this experimentation will be continued, even if it must be done by the individual growers, for I feel thoroughly confident of the ultimate success of these efforts.

GRUB DISEASES.

In my reports for January and February I alluded to the presence of the Muscardine fungus again in the fields at Greenhills. Naturally, the excessive moisture of the past month has been ideal for the development of these lowly organisms; hence a real epidemic has developed among the grubs in the fields wherever the spores occurred in the soil. On the 13th April we dug three stools in one of the abandoned fields in the same place where the grubs had died off in such numbers last season, and found only three living grubs, though there were many remains of grubs in various stages of disintegration that had succumbed both to the Muscardine fungus and the bacterial disease. Since, earlier in the year when the grubs were just hatching, we found an average of over 100 per stool in this location, it would appear that the contagion has again destroyed fully 99 per cent. of the pest in these favoured spots.

Unfortunately, these diseases do not occur throughout the plantation, for if they did it would be a serious blow to the grub pest there.

In previous reports I have recommended the inoculation of infested fields with this spore-laden soil, and consider this a most feasible line of experimentation. Moreover, it has occurred to me that this application could probably be most easily made by sprinkling a little of the infected soil over the plants in the planter. In this way every part of the field would probably become inoculated at the same time. Once we find a successful method of establishing these friendly organisms throughout our grubby areas I feel confident that it will go far towards mitigating this serious damage.

SOUTHERN TRIP.

During the month, in compliance with an urgent request from Mr. W. N. Gillies, the Minister for Agriculture, I went to Home Hill to confer with the members of the Inkerman Farmers' Association on a borer which they reported had been doing considerable damage to their cane. Fortunately I found that this was not the New Guinea beetle (*Rhabdocnemis obscura* Boisd.) which they had reported, but the far-less-destructive native moth borer (*Phragmatiphila truncata* Walk.) which is usually held well in check by the two hymenopterous parasites, *Apanteles nonagriae* Olliff and *Euplectrus howardi* Olliff. These borers were only seen in old standover cane and were doing little damage, so artificial control measures were not advisable.

A much-more-serious borer that I found there in some of the sandy-loam fields near the river was the large Termite (white ant), *Mastotermes darwiniensis* Froggatt. Fortunately this pest is not general, for if it were, no cane could be grown. The whole pithy contents of long sticks had been removed from bottom to top, leaving only a thin hard rind, which still supported the green leaves of the plant. These same "ants," I am informed by Mr. G. F. Hill, are notorious devastators in the Northern Territory, where they will not permit sugar-cane to grow at all, and even hollow out and ringbark large trees, such as figs, cocoanuts, &c. Moreover, they also destroy every organic product that is left within their reach, even eating one's boots if left on the ground overnight.

A disease closely resembling the Top-rot, of Hawaii, described by Dr. N A. Cobb,* really gives more trouble on the Lower Burdekin than any of the insect pests. This is not a very virulent disease, however, and it will probably be soon overcome by judicious selection of plants, especially in a region of such little rainfall.

EFFICIENT GRUB DESTROYERS.

During a hurried survey, both at Inkerman and at Pioneer, I was surprised to find grubs so scarce behind the ploughs. I was told, however, by observant farmers that the ibises (*Carphibis spinicollis* Reich, and *Ibis molucca* Cuvier) were always there, and I also saw great flocks of crows (*Corvus australis*) following the ploughs. Though few grubs were turned up, they found many earthworms, &c. The ibises, I was told by Mr. A. C. F. Hemsley, a collector of birds' eggs for the Associated Museums, breed in great colonies near the mouth of the Haughton River. This evidently accounts for the continued presence of these efficient grub destroyers in those districts, and probably accounts largely for the scarcity of grubs. Unfortunately the ibises are absent from the Cairns district from about February to June, at a time when they could be of the utmost service to us in destroying grubs, and the crows, as far as I know, do not occur at all.

I had many courtesies extended to me during this brief visit to the Lower Burdekin Valley, both by the farmers and the officials of the Pioneer Mill, which greatly facilitated my investigations, for which I wish to express my most sincere appreciation.

RATS, MATCHES, AND FIRES.

The Rev. A. H. Lambton, St. Alban's Rectory, Innisfail writes:—"In regard to the statement that rats do not cause fire by lighting matches, my own experience in the matter might interest you. Some years ago I was living on Charters Towers, and one night I heard a noise in the kitchen and went out to investigate. As I opened the door I saw a match flare up on a shelf above the fireplace. By the light of that 'self-lighted match' I saw a rat scampering off as hard as he could. That little experience really convinced me that rats do light matches and so cause fires."

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* Hawaiian Sugar Planters' Assn., Div. Path. and Physiol., Circ. No. 5, and also given more fully in Bul. No. 6.

General Notes.

EUCALYPTUS OIL.

Mr. C. T. White, F.L.S. (Government Botanist), replies to an inquirer as follows:—

Practically the only oil being distilled in Queensland is the oil from *Eucalyptus citriodora*, the citron-scented spotted gum. Queensland is remarkably rich in these scented oils, at least two Eucalypts, two species of tea-tree, and a Backhousia possessing rich citron-scented oils. These oils are used principally in scent manufacture. On the other hand, we are poor in oils of a standard medicinal value. To comply with British Pharmacopœia standards, Eucalyptus oil must have at least a 55 per cent. eucalyptol (*i.e., cineol*) content, and the United States Pharmacopœia demands a eucalyptol content of at least 70 per cent. Only one Queensland species, so far as I know, goes so high in the eucalyptol constituent of its oil, viz., the common Bimbil box or Box of the Downs and inland country (*Eucalyptus populifolia*). This is, however, a poor yielder.

Pure Eucalyptol is manufactured in Australia, but it is beyond the scope of the work of the ordinary distiller, requiring chemical knowledge. The best plan for your inquirer to adopt would be for him to let his correspondents know what species of eucalypts he has growing in his district and the price he wants for the oil. The present price for oils rich in eucalyptol is quoted at 3s. per lb. in London. It would, of course, be considerably less in Australia. They have nothing like the value of the citron-scented oils. A useful work on eucalyptus oils is "A Research in the Eucalypts and their Essential Oils," 2nd edition, by R. T. Baker and H. G. Smith, obtainable from the Government Printer, Sydney, or from the Technological Museum, Harris street, Ultimo, Sydney. It is a big book, and the price is £2.

If there are any eucalypts of which your inquirer wants the name, if he sends pieces about 6 to 9 inches long, bearing leaves and fruits or flower buds, we will identify them. It is a great help to have the local names and a note on the bark, thus—stringy, smooth, white, and so on, as the case may be.

There was an embargo on the exportation of eucalyptus oils from Australia, but this the Customs Department informs me has been lifted.

PUBLICATIONS RECEIVED.

"The Journal of Agriculture" (United Kingdom) for April contains an interesting article, the first of a series, on "Research in Animal Breeding," in which is discussed the nature of Mendel's discovery, and efforts made to acquire knowledge of laws which underlie inheritance in animals generally. "The Human Machine on the Land" is another article, in which the cost of inefficiency and misdirection of energy on the farm is dealt with.

"The Agricultural Gazette of New South Wales" for May.—Under the caption "A Promising Introduction," Mr. J. N. Whittet, Assistant Agrostologist, writes informately on Kikuyu Grass. All reports received show that this importation from the Belgian Congo is giving very good results down South, especially in coastal districts. The conclusions arrived at by the writer are summarised as follows:—"Kikuyu is propagated by means of cuttings, rooted runners, or divisions of the crown of the plant. It grows well on almost any kind of soil. Temperate situations with good rainfall are most suitable, as the grass thrives where the spring and summer seasons are long. It stands frost fairly well. Reports from other parts of the world state that it is an excellent drought resister. Spring and early summer plantings are recommended in cold districts; any time from September to March in other parts, provided the soil is moist enough to enable the plants to become well rooted. It is recommended for planting in soil subject to erosion. It should be useful in bracken fern country, as it would tend to smother the fern. It should be permitted to become well established before being fed off, as the cattle may tear up the runners if they are not well rooted. As the plant does not form seed, it should not be difficult to keep it in check if so desired."

In the same issue appears an important paper, "Tick Paralysis," describing the result of various experiments confirming the fact "that one of the so-called 'scrub' ticks (*Ixodes holocyclus*) is capable of producing a very fatal affection in animals, the main feature of which is a progressive motor paralysis."

"Tropical Life" (London) for March, in a leading article on "Cotton Growing within the Empire," calls attention, *inter alia*, to the expansion of the cotton industry in the United States of America with consequent depletion of supplies of raw material for British and Continental manufacturers. A big market is therefore created for raw cotton, and the demand is increasing much faster than the supply. "The tendency is for prices to harden and the grower need have no fear of over-production." On the cotton outlook the article goes on to say—"Of the world's population about 500,000,000 are properly clad, 750,000,000 partly dressed, and 250,000,000 practically naked. The population of the world is getting more civilised, and the first requirement, next to food, is clothing in some form. The production of other textiles is so limited that at present the only solution seems to be in a much greater production of cotton."

It is interesting to note that the article, while describing efforts to open up more cotton fields in the British Dominions, makes no reference to Queensland's possibilities in that connection.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING APRIL, 1921 AND 1920, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	April.	No. of Years' Records.	April, 1921.	April, 1920.
North Coast.	In.		In.	In.
Atherton	4·33	20	11·59	4·03
Cairns	12·00	39	19·72	19·37
Cardwell	9·99	49	3·38	15·32
Cooktown	9·32	45	5·99	14·49
Herberton	4·21	34	7·64	2·63
Ingham	9·21	29	3·07	20·11
Innisfail	21·95	40	19·93	31·33
Mossman	12·52	13	11·86	25·84
Townsville	3·97	50	0·32	18·47
Central Coast.				
Ayr	3·02	34	0·31	11·30
Bowen	3·00	50	0·23	1·73
Charters Towers ...	1·84	39	0·27	4·68
Mackay	6·94	50	3·20	8·74
Proserpine	7·04	18	4·89	8·32
St. Lawrence ...	2·89	50	0·44	0·78
South Coast.				
Biggenden	1·68	22	4·01	1·42
Bundaberg	2·78	38	8·81	1·53
Brisbane	3·64	70	8·06	2·00
Childers	2·30	26	8·47	0·61
Crohamhurst ...	5·42	25	14·66	6·33
Esk	2·63	34	4·85	2·25
Gayndah	1·33	50	1·07	0·76
Gympie	3·08	51	6·76	1·93
Glasshouse M'tains	4·86	13	9·31	6·71
Kilkivan	2·06	42	3·69	1·28
Maryborough ...	3·24	50	9·76	2·41

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	April.	No. of Years' Records.	April, 1921.	April, 1920.
South Coast—continued:	In.		In.	In.
Nambour	4·82	25	11·52	6·36
Nanango	1·87	39	1·94	2·17
Rockhampton ...	2·32	34	1·21	1·39
Woodford	4·11	34	8·94	3·78
Darling Downs.				
Dalby	1·28	51	0·15	0·34
Emu Vale	1·20	25	1·27	0·90
Jimbour	1·33	33	0·19	0·33
Miles	1·46	36	0·13	0·22
Stanthorpe ...	1·72	48	1·48	1·37
Toowoomba ...	2·49	49	3·27	1·68
Warwick	1·38	34	1·17	1·11
Maranoa.				
Roma	1·31	47	Nil	0·59
State Farms, &c.				
Bungeworgorai ...	0·99	7	0·01	0·56
Gatton College ...	1·69	22	1·83	0·51
Gindie	1·29	22	0·08	0·85
Hermitage ...	1·37	15	0·64	0·70
Kairi	4·24	7	14·70	5·98
Sugar Experiment Station, Mackay	5·54	24	2·76	7·28
Warren	1·41	7	0·85	0·70

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for April, 1921, and for the same period of 1920, having been compiled from telegraphic reports, are subject to revision.

J. H. HARTSHORN,
Acting State Meteorologist.

Answers to Correspondents.

W.K.B. (Chinchilla).—The subject suggested is already in hand, and the first of a series of articles will appear shortly.

THE ORCHARD.

E.A.T. (Llanelly, via Roma).—Your inquiries with regard to citrus trees and the propagation of the grape by cuttings were referred to Mr. C. Ross, Instructor in Fruit Culture, who advises as follows:—

"*Protecting Citrus Trees from Frost.*—The method suggested in the last paragraph of your letter—viz., covering the main stem and branches with loose bagging in addition to covering over trees with bush roofing—is as good as any that could be recommended, with the addition of a good surface mulch of dead grass or straw.

"*Propagation of the Grape by Cuttings.*—Prepare short jointed cuttings about 18 inches in length by making a clean cut ½ an inch below the base eye. If they are to be rooted in a bed for transplanting the following season, the cuttings should be dibbled in two-thirds of their length with a bar, leaving one, two, or three buds above ground level. The base of each cutting should be well tamped. A good sandy loam deeply and thoroughly pulverised is the most essential for a good strike. The cuttings may be inserted 1 foot apart in rows at 3 feet intervals. When cuttings are planted in permanent positions in the vineyard, 6 feet is usually the distance from plant to plant and the rows 9 to 10 feet apart."

ZAMIA AND RICKETS.

A. PEARCE (Moongan).—Your letter was referred to the Government Botanist, Mr. C. T. White, who advises as follows:—

(1) All the Cycadaceæ or Zamia family cause rickets in cattle.

(2) The "Zamia" is definitely poisonous.

(3) *Bowenia* (a so-called "Zamia Fern" or "Fern Zamia"): This plant, though different from other members in appearance, is one of the Zamia family, and is harmful to cattle, causing the disease known as rickets.

(4) Is there any cure for the rickets?—Little can be done in this direction. The Chief Inspector of Stock (Major A. H. Cory, M.R.C.V.S.) has recommended the following:—"The first action to be taken is to prevent the animals gaining access to the plant, and a purgative should be given to the affected animals, consisting of ¾ of a pound to 1 pound of Epsom salts in 3 pints of water, as a drench. After the drench has worked, the animals should be given the following powder twice daily, either mixed in food or in a pint of cold water:—Potassium iodide, 2 drachms; Powdered nux vomica, 1 drachm; Powdered gentian, 4 drachms.

CAROB AND ALGAROBA BEANS.

"FARMER" (Mackay).—See article on the Carob and Algaroba beans in this issue by Mr. C. T. White, F.L.S., Government Botanist. The Curator of the Botanic Gardens has been asked to send you a few seeds of the Algaroba Bean, supplies of which are at present very limited. Carob seeds are now very difficult to obtain. An application to the Curator, Botanic Gardens, Adelaide, or Messrs. Bunning and Co., Melbourne, may bring a satisfactory response. Tree tomato seed is obtainable from T. H. Wood, Seedsman, George street, Brisbane. Price, 10s. per dozen.

CASTOR OIL PLANT.

R. F. MICHIE.—All the information you desire is covered by an article on "The Castor Oil Plant in Queensland" by Mr. Daniel Jones, and which appeared in the "Journal" for June, 1919. We are forwarding you a copy direct.

WATERCOURSE BOUNDARIES.

"INQUISITIVE" (Mossman).—The Department of Public Lands advises as follows:—If an alteration of the channel of a boundary watercourse should take place suddenly, say, through the agency of flood waters, it would be fully within the rights of the owners of the land on each side of the watercourse, or the owner on one of the sides, to restore the original condition of things. If, however, the alteration of the channel of a boundary watercourse is gradual and imperceptible or beyond the power of neighbouring owners to resist, as is common in the case of a crooked watercourse caused by gradual erosion in places and accretion or silting up in other places, the resulting water channel must be regarded as the boundary between the properties.

The Markets.

The following mid-month (14th May, 1921) market survey is abridged from weekly departmental summaries of prospects and prices:—

Agricultural.—The Downs received beneficial rains in the course of the second week, the highest registration being 115 pts. at Bell. Dalby recorded 108 pts. The favoured area extended into the South-West as far as Surat and St. George, where thunderstorms precipitated 140 pts. Thunderstorms were reported from Rockhampton, Maryborough, and Kingaroy, while the coastal areas generally were fairly well served. The Maranoa was still in want of rain, and the Boonah district was unfortunate in missing most of the sea-board falls. Field operations were being delayed in consequence, but it is hoped that situation has been relieved by more recent downpours.

The markets were generally described as dull and all lines in reduced demand.

Produce.	Price.	Demand.
Chaff—		
Lucerne	4s. 9d. to 9s.	Weak.
Mixed	4s. 1d. to 7s. 1d. ..	Inactive. Primes withheld, 6s. 6d.
Oaten	Local, 4s.; Imported, 8s.	Large offerings withheld.
Maize	3s. 9½d. to 3s. 11d.	
Potatoes	4s. to 6s. 9d.	Weak. Supplies heavy.
Sweet Potatoes	Up to 2s. 6d.	Practically unsaleable.
Pumpkins..	Up to 4s. 8d.	
Chick Wheat	4s. to 5s. 9d.	
Barley	2s. 9d. offered.	
Broom Millet	£23 to £28 per ton	

Dairy Produce.—Quantity graded for week ended 14th May, 1921—Butter, 13,908 boxes (56 lb. each); cheese, 178 crates (142 lb. each). In cold storage awaiting shipment on 15th May, 1921—Butter, 35,474 boxes (56 lb. each); cheese, 465 crates (142 lb. each). The bulk of supplies, first grade butter, went to Southern States.

Fruit.—Bananas continue to go South in large quantities by rail, both from the Tweed and Blackall Range districts, and are readily quitted.

The pineapple Winter crop coming forward. On account of late rains the fruit matured well and found favour in the South.

Oranges and mandarins are coming forward from Northern ports in marked contrast, in respect to condition, to last year's consignments for the corresponding period.

This seasons prolific strawberry crop promises the creation of market difficulties. Efforts are being made to induce canners to contract for the heavy output.

Stanthorpe vegetables, particularly cabbage, quitted daily at prices generally satisfactory to the grower.

Apples and pears are being received in large consignments by direct steamer from Tasmania.

Fat Stock.—Cattle: 1,200 were yarded for the second week in May. Most of the yarding was made up of useful trade beef, but prime pens were not many. Competition good, values less firm than preceding week, due to larger supplies. Good and prime ranged from 26s. to 28s. per 100 lb. An occasional pen of choice lightweights went to 30s. Cows, good and prime, realised from 20s. to 25s. per 100 lb.

Sheep: About 6,800 penned, chiefly good mutton. Prime wethers scarce. Values below previous week's rates. Demand fairly firm, useful lines readily quitted. Good and prime wether mutton averaged about 3d. per lb. An occasional choice pen went to 4d. Good ewes were worth about 3d. per lb.

Orchard Notes for July.

THE SOUTHERN COAST DISTRICTS.

The notes for the month of June apply to July as well. The first crop of strawberries will be ripening during the month, though extra early fruit is often obtained in June, and sometimes as early as May, under especially favourable conditions. Look out for leaf-blight, and spray for same with Bordeaux mixture, also watch for the first signs of the grey mould that attacks the fruit, and spray with the sulphide of soda wash. The larvæ of the cockchafer, that eats the roots of strawberries, should be looked for, and destroyed whenever found. Pruning of citrus and other fruit trees may be continued; also, the spraying with lime and sulphur. Where the ringing borer, that either attacks the main trunks or the branches at or near where they form the head of the tree, is present, the main stems and trunks should either be painted or sprayed with the lime and sulphur wash during the month, as the mature beetles that lay the eggs that eventually turn to the borers sometimes make their appearance during the month, and unless the trees are protected by the wash they lay the eggs, which hatch out in due course and do a lot of damage. Keep the orchard clean, so that when the spring growth takes place the trees may be in good condition. There is usually a heavy winter crop of pineapples ripening during this and the following month, particularly of smooth leaves. See that any conspicuous fruits are protected by a wisp of grass, as they are injured not only by frost but by cold westerly winds.

THE TROPICAL COAST DISTRICTS.

See the instructions given for the month of June. Keep the orchards clean and well worked. Prune and spray where necessary.

THE SOUTHERN AND CENTRAL TABLELANDS.

Where pruning of deciduous trees has not been completed, do so this month. It is not advisable to leave this work too late in the season, as the earlier the pruning is done after the sap is down the better the buds develop—both fruit buds and wood buds; thus securing a good blossoming and a good growth of wood the following spring.

Planting can be continued during the month; if possible, it should be finished this month, for, though trees can be set out during August, if a dry spell comes they will suffer, when the earlier planted trees, which have had a longer time to become established, will do all right—provided, of course, that the land has been properly prepared prior to planting, and that it is kept in good order by systematic cultivation subsequent to planting.

Do not neglect to cut back hard when planting, as the failure to do so will result in a weakly growth.

As soon as the pruning is completed, the orchards should get their winter spraying with the sulphur limewash, and either with or without salt, as may be wished. See that this spraying is thoroughly carried out, and that every part of the tree is reached, as it is the main treatment during the year for San José and other scale insects, as well as being the best time to spray for all kinds of canker, bark-rot, moss, lichens, &c.

Where the orchard has not been ploughed, get this done as soon as the pruning and spraying are through, so as to have the land in good order for the spring cultivations. See that the work is well done, and remember that the best way to provide against dry spells is to keep moisture in the soil once you have got it there, and this can only be done by thorough and deep working of the soil.

When obtaining trees for planting, see that they are on good roots, and that they are free from all pests, as it is easier to prevent the introduction of pests of all sorts than to eradicate them once they have become established. Only select those varieties that are of proved merit in your district; do not plant every kind of tree that you see listed in a nurseryman's catalogue, as many of them are unsuited to our climate. The

pruning of grape vines may be carried out in all parts of the tablelands other than the Stanthorpe district, where it is advisable to leave this work as long as possible, owing to the danger of spring frosts.

Where grape vines have been well started and properly pruned from year to year, this work is simple; but where the vines have become covered with long straggling spurs, and are generally very unsightly, the best plan is to cut them hard back, so as to cause them to throw out good strong shoots near the main stem. These shoots can be laid down in the place of the old wood in following seasons, and the whole bearing portion of the vine will be thus renewed.

Where vineyards have been pruned, the prunings should be gathered and burnt, and the land should receive a good ploughing.

Farm and Garden Notes for July.

FIELD.—The month of July is generally considered the best time to sow lucerne, for the reason that the growth of weeds is then practically checked, and the young lucerne plants will, therefore, not be retarded by them, as would be the case if planted later on in the spring. If the ground has been properly prepared by deep ploughing, cross-ploughing, and harrowing, and an occasional shower occurs to assist germination and growth, the lucerne will thrive so well that by the time weeds once more appear it will be well able to hold its own against them. From 10 to 12 lb. of seed drilled, or 15 to 16 lb. broadcast, will be sufficient for an acre. This is also the time to prepare the land for many field crops, such as potatoes, maize, oats, and barley for green fodder; also, rye, vetches, tobacco, cotton, sugar-cane, field carrots, mangolds, swedes, canaigre, &c. Early potatoes, sugar-cane, and maize may be planted in very early districts, but it is risky to plant potatoes during this month in any districts liable to late frosts or in low-lying ground. Under such conditions, it is far better to wait until well into the following month. The greatest loss in potatoes and sugar-cane has been, on more than one occasion, experienced in September, when heavy frosts occurred in low-lying districts in the Southern portion of the State. During suitable weather, rice may be sown in the North. The coffee crop should now be harvested, and yams and tumeric unearthed.

KITCHEN GARDEN.—Should showery weather be frequent during July, do not attempt to sow seeds on heavy land, as the latter will be liable to clog, and hence be injurious to the young plants as they come up. The soil should not be reworked until fine weather has lasted sufficiently long to make it friable. Never walk over the land during wet weather with a view to sowing. The soil cakes and hardens, and good results cannot then be expected. This want of judgment is the usual cause of hard things being said about the seedsman. In fine weather, get the ground ploughed or dug, and let it lie in the rough till required. If harrowed and pulverised before that time, the growth of weeds will be encouraged, and the soil deprived of the sweetening influences of the sun, rain, air, and frost. Where the ground has been properly prepared, make full sowings of cabbage, carrot, broad beans, lettuce, parsnips, beans, radishes, leeks, spring onions, beetroot, eschalots, salsify, &c. As westerly winds may be expected, plenty of hoeing and watering will be required to ensure good crops. Pinch the tops of broad beans which are in flower, and stake up peas which require support. Plant out rhubarb, asparagus, and artichokes. In warm districts it will be quite safe to sow cucumbers, marrows, squashes, and melons during the last week of the month. In colder localities, it is better to wait till the middle or end of August. Get the ground ready for sowing French beans and other spring crops. Sow Guada beans (snake gourd) at the end of September.

FLOWER GARDEN.—Winter work ought to be in an advanced state. The roses will now want looking after. They should already have been pruned, and now any shoots which have a tendency to grow in wrong directions should be rubbed off. Overhaul the ferneries, and top-dress with a mixture of sandy loam and leaf mould, staking up some plants and thinning out others. Treat all classes of plants in the same manner as the roses where undesirable shoots appear. All such work as trimming lawns, digging beds, pruning, and planting should now be got well in hand. Plant out antirrhinums, pansies, hollyhocks, verbenas, petunias, &c., which were lately sown. Sow zinnias, amaranthus, balsam, chrysanthemum tricolor, marigolds, cosmos, cox-combs, phloxes, sweet peas, lupins, &c. Plant gladiolus, tuberose, amaryllis, pan-cratium, ismene, crinums, belladonna, lily, and other bulbs. Put away dahlia roots in some warm, moist spot, where they will start gently and be ready for planting out in August and September.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT BRISBANE.

1921.	MAY.		JUNE.		JULY.		AUGUST.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	6·11	5·16	6 31	5·0	6 39	5 3	6 30	5·18
2	6·14	5 16	6·31	5 0	6·39	5·3	6·30	5·18
3	6·15	5·15	6 32	5·0	6 39	5·4	6·29	5 19
4	6·15	5·14	6·32	5·0	6·39	5·4	6·28	5·19
5	6·16	5 13	6·33	5·0	6·39	5·5	6·27	5 20
6	6 16	5·13	6·33	5·0	6·39	5·5	6·27	5 21
7	6·17	5·12	6·34	5 0	6 39	5·5	6 26	5 21
8	6·17	5·11	6 34	5 0	6·39	5·6	6 25	5·22
9	6·18	5·10	6·34	4·59	6·39	5·6	6·25	5·22
10	6 18	5·10	6·35	4·59	6·40	5 6	6·24	5 23
11	6 19	5·9	6·35	4 59	6 40	5·7	6·23	5 23
12	6·19	5·8	6·35	4 59	6·39	5·7	6 22	5·24
13	6·20	5·8	6 35	4 59	6·38	5 8	6·21	5 24
14	6 20	5 7	6 36	4·59	6·38	5·8	6·20	5·25
15	6·21	5·7	6·36	5·0	6·38	5 9	6 19	5 25
16	6·22	5 6	6·36	5·0	6·37	5·10	6·18	5·26
17	6·22	5·5	6 37	5 0	6 37	5·10	6 17	5·26
18	6 23	5·5	6·37	5 0	6 37	5·11	6·16	5 27
19	6 23	5·4	6·37	5·0	6 36	5·11	6·15	5·27
20	6·21	5·4	6·38	5 0	6·36	5·12	6·14	5·28
21	6·21	5·3	6·38	5 1	6 36	5·12	3·14	5·28
22	6·25	5 3	6 38	5 1	6·35	5·13	6 13	5·28
23	6 26	5·3	6·38	5 1	6 35	5·13	6·12	5·29
24	6 26	5·2	6 38	5·1	6 35	5·14	6·11	5·29
25	6·27	5·2	6 39	5 1	6·34	5·14	6 10	5 29
26	6·28	5 2	6·39	5·2	6 34	5·15	6 9	5·30
27	6 28	5·1	6·39	5·2	6·33	5·15	6 8	5 30
28	6 29	5·1	6 39	5 2	6 33	5·16	6·7	5·31
29	6·29	5·1	6·39	5 2	6·32	5·16	6·6	5·31
30	6·30	5·0	6·39	5·3	6·32	5·17	6·5	5·32
31	6·31	5 0	6 39	5·3	6·31	5·17	6·4	5·32

PHASES OF THE MOON, ECLIPSES, &c.

(The times stated are for Queensland New South Wales, and Victoria, where the clock time is identical).

			H.	M.
8 May.	●	New Moon	7	2 a.m.
15 „	☾	First Quarter	1	25 a.m.
22 „	○	Full Moon	6	15 a.m.
30 „	☽	Last Quarter	7	45 a.m.

Perigee on 12th at 6·12 a.m.
Apogee on 27th at 8·48 p.m.

6 June	●	New Moon	4	14 p.m.
13 „	☾	First Quarter	7	0 a.m.
20 „	○	Full Moon	7	41 p.m.
28 „	☽	Last Quarter	11	17 p.m.

Perigee on 8th at 6·51 p.m.
Apogee on 24th at 11·42 a.m.

5 July	●	New Moon	11	36 p.m.
12 „	☾	First Quarter	2	16 p.m.
20 „	○	Full Moon	10	8 a.m.
28 „	☽	Last Quarter	12	20 p.m.

Perigee on 6th at 10·54 p.m.
Apogee on 21st at 8·18 p.m.

4 Aug.	●	New Moon	6	17 a.m.
11 „	☾	First Quarter	12	14 a.m.
19 „	○	Full Moon	1	28 a.m.
26 „	☽	Last Quarter	10	51 p.m.

Perigee on 4th at 7·48 a.m.
Apogee on 17th at 10·54 p.m.

No Eclipse of the Sun or Moon will occur till October.

On 2nd July, between 3 and 4 p.m., an interesting occultation of the planet Venus will be taking place; but in Queensland the only thing observable will be the juxtaposition of the two, and binoculars will be required as it will be day-time. The position will be about half-way down to the west of the Sun.

For places west of Brisbane, but nearly on the same parallel of latitude—27½ degrees S. —add 4 minutes for each degree of longitude. For example, at Toowoomba the sun would rise about 4 minutes later than at Brisbane if it were not for its higher elevation, and at Oontoo (longitude 141 degrees E.) about 48 minutes later.

At St. George, Cunnamulla, and Thargomindah the times of sunrise and sunset will be about 18 m., 30 m., and 38 minutes respectively, later than at Brisbane.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.